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THE ESSENTIALS OF ARITHMETIC

BOOK I.

WITHOUT
ANSWERS

LEACH, SHEWELL, & SANBORN
BOSTON · NEW YORK · CHICAGO

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THE

ESSENTIALS OF ARITHMETIC

ORAL AND WRITTEN

BOOK I

FOR LOWER GRADES

GORDON A. SOUTHWORTH
MASTER OF THE PRESCOTT SCHOOL, SOMERVILLE, MASSACHUSETTS

LEACH, SHEWELL, AND SANBORN
BOSTON AND NEW YORK

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THE ESSENTIALS OF ARITHMETIC. Book I. For Lower Grades.

THE ESSENTIALS OF ARITHMETIC. Book II. For Higher Grades.

Both books are published with and without answers.

Key to Book II. for use of Teachers only.

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Norwood Press:
J. S. Cushing & Co. — Berwick & Smith.
Boston, Mass., U.S.A.

PREFACE.

This book is designed for use within the third-, fourth-, fifth-, and sixth-year grades of public schools. Whether it shall be used three years or four depends upon the length of the course and the time allotted to the subject of arithmetic. It assumes such knowledge of numbers as may generally be acquired in the pupil's first two school years.

The present tendency to subordinate arithmetic to other studies is recognized, and hence some subjects, hitherto made prominent in text-books, have been presented less fully, or altogether omitted.

In the preparation of the book two objects have been constantly in view: first, the training of the pupil in thinking and reasoning about matters involving the use of numbers. This has been mainly done by dealing with small numbers only, and with such subjects as the subsequent needs of the pupil will require him to know and use. The second object has been to secure through abundant and varied exercises and practice the accuracy and facility in the more mechanical uses of numbers required by the demands of business.

The work to be done has been arranged, not topically on the assumption that one subject is to be finished before even the elements of another are begun, but in the order of study which prevails in the best schools. An ample index, however, is available for those who may still prefer the old plan.

Oral and written exercises in the same subject are presented generally on opposite pages, and in nearly equal number. Principles and processes are developed and taught without formal rules by induction, illustrations, and examples, and are to be fixed by continued practice.

It is believed that this book thoroughly completed will not only qualify pupils to continue their grammar-school course to the best advantage, but that it will also secure such a practical knowledge of numbers as will meet the future requirements of the less fortunate whose circumstances may compel them to leave school earlier.

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SUGGESTIONS TO TEACHERS.

THE pupil should constantly discriminate between numbers and the characters that represent them.

Objects should be used until clear ideas of numbers, processes, and principles are obtained. The purpose of objective teaching, however, is to enable the pupil to think without objects. This purpose accomplished, their use should be discontinued.

"Telling is not teaching." The pupil should be given ample time and opportunity to think and learn for himself. Knowledge should be subordinated to training.

Oral exercises are presented in both the interrogative and the assertive form. Assertions may first be read silently and then aloud, the blanks being properly filled. Questions may be read orally, and the answer announced or the process analyzed; or, after being silently read, they may be changed to assertions in which the answer is incorporated as an element. If dictated, the assertive form may be easily made interrogative.

Variety in oral and written forms of expression should be used and allowed. An original analysis by the pupil, even if imperfect, is better than a perfect but set form recited from memory.

Oral exercises in a given subject should generally precede written exercises, and constant care and frequent statement of principles and processes should prevent the latter from becoming purely mechanical.

Exercises have been given in sufficient numbers to meet the requirements of all pupils, but no one need feel obliged to use more of them than are requisite to secure the object which they are intended to accomplish.

THE
ESSENTIALS OF ARITHMETIC.

BOOK I.

1. – Writing and Reading Numbers.

1. How many seasons in the year? **2.** How many days in a week? **3.** How many cents in a dime? **4.** How many stripes in our flag?

In answering these questions we have used **numbers,** four, seven, ten, thirteen.

Numbers are used to show *how many.*

5. Name the numbers from *one* to *nine* by counting.

1, 2, 3, 4, 5, 6, 7, 8, 9 are **Figures,** and stand for the first nine numbers. The tenth figure, 0, is called *zero* or *cipher;* it stands for *nothing.*

6. Count from ten to twenty; from ninety to one hundred.

To write numbers between *nine* and *one hundred* we use **two figures** side by side. Thus:—

ten	10	twenty	20	thirty-six	36	seventy-eight	78
fifteen	15	twenty-four	24	fifty-two	52	ninety-nine	99

7. Count from one hundred to one hundred twenty.

To write numbers between ninety-nine and one thousand we use **three figures** side by side. Thus:—

One hundred	100	Four hundred thirty-five	435
One hundred ten	110	Five hundred eight	508
Two hundred sixteen	216	Nine hundred ninety-nine	999

8. Read 197, 918, 67, 607, 742, 848, 809, 955, 1000.

9. Write such numbers as your teacher may dictate.

2.—Addition.

ORAL.

1. If I put 4 books and 3 books together, I shall have 〰 books.
2. When I add 5 pencils to 6 pencils, I shall have 〰 pencils.
3. James put 3 cents, 5 cents, and 2 cents into his bank, and then it contained 〰 cents.
4. The next day he added 4 cents and 2 cents, and then his bank had 〰 cents in it.
5. Seven apples and 8 apples are 〰 apples.
6. Eight slates added to 6 slates make 〰 slates.
7. Put 5 eggs and 7 eggs into a basket together, and then it will contain 〰 eggs, or just a 〰.
8. Eight boys and 5 boys are 〰 boys, and if 3 boys more join them, there will be 〰 boys.
9. By putting 9 things and 8 things together we get 〰 things.

Putting two or more numbers together to find their sum is **Addition.**

10. Add 5 pencils to 8 pencils, and the sum is 〰 pencils.
11. What is the sum of 4 cents and 10 cents? How do you find it?

The **sign of addition** is +, named *plus*. It is generally read *and*. The **sign of equality** is =. It may be read *are*. The **sign of dollars** is $. Thus: —

$8+$7=$15 is read 8 dollars *and* 7 dollars *are* 15 *dollars*.

12. 12 cents + 8 cents = 〰
13. 9 pounds + 11 pounds = 〰
14. 7 leaves + 9 leaves = 〰
15. 8 + 4 + 7 = 〰

Fill the blanks below with any numbers less than 20: —

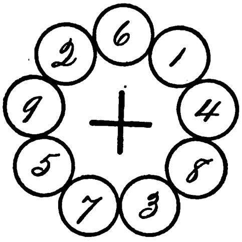
16. I went to a store and spent 〰 cents for a book, 〰 cents for a slate, and 〰 cents for a pencil. By adding these numbers I find that I spent in all 〰 cents.

3.—For Practice in Addition.

	A	*B*	*C*	*D*	*E*	*F*
1.	·2+8	·5+2	·2+6	·8+7	·1+7	·2+5
2.	·6+3	·2+2	·8+1	·7+1	·5+8	·7+3
3.	·9+1	·8+6	·6+4	·7+4	·2+3	·5+9
4.	·4+4	·9+8	·9+2	·4+3	·1+4	·6+5
5.	·2+7	·8+9	·6+8	·5+7	·1+1	·2+1
6.	·8+2	·9+6	·1+9	·3+1	·9+3	·7+2
7.	·3+5	·3+9	·1+3	·6+2	·7+9	·0+6
8.	·4+7	·9+9	·5+5	·7+6	·3+7	·1+5
9.	·4+1	·6+9	·2+4	·8+8	·5+4	·8+4
10.	·3+3	·4+2	·6+1	·4+6	·9+7	·1+6
11.	·3+6	·9+5	·5+3	·4+9	·9+4	·8+0
12.	·2+9	·8+5	·5+6	·7+8	·3+2	·5+1
13.	·7+5	·6+6	·7+7	·1+8	·3+4	·7+0
14.	·8+3	·4+8	·6+7	·3+8	·4+5	·1+2

Note.—This table contains all the primary combinations in addition, and should be used until the pupil is perfectly familiar with them. Amounts may be given by columns or by lines. Any figure may take the place of the dot, and thus practice in secondary combinations may be given.

Give the sum of the numbers in each line or column:—

	A	*B*	*C*	*D*
1.	3, 2, 5	3, 4, 2, 5	5, 4, 3, 7	
2.	4, 3, 2	2, 3, 4, 6	6, 8, 4, 3	
3.	5, 4, 3	6, 3, 2, 4	2, 9, 6, 2	
4.	6, 2, 4	5, 7, 3, 6	4, 6, 8, 3	
5.	5, 3, 2	8, 4, 2, 3	7, 8, 4, 9	
6.	Begin at any number in the circle and add in either direction until the sum exceeds 60.			

4.—Subtraction.

ORAL.

1. If I have 8 cents in my purse and take out 5 cents, there will be left 〰 cents.
2. In a basket there are 12 eggs. I take out 7, and 〰 eggs remain in the basket.
3. On the shelf are 14 books. Mary takes away 5 of them, and 〰 remain.
4. Ellen has 7 pinks; two of them are white, and the remainder are red. How many are red?
5. Charles had 20 cents, but spent 12 cents for a book. Then he had 〰 cents remaining.
6. If 10 is one part of 17, the other part must be 〰.

Taking a part of a number out of it to find the remainder is **Subtraction.**

7. Take 4 pencils out of a bunch of 12, and the remainder is 〰 pencils.
8. Edward had 19 marbles, and James had 14. Edward had 〰 more than James.

We use subtraction in finding the *difference* between two numbers. The **Sign of Subtraction,** −, is called *less*.

The sign ¢ stands for *cents*. Thus:—

15¢ − 12¢ = 3¢ is read 15 cents *less* 12 cents is 3 cents.

9. $13 − $7 = 〰
10. 25¢ − 8¢ = 〰
11. $9 subtracted from $26 leaves 〰
12. 3¢ taken out of 30¢ leaves 〰

13. From each of these numbers subtract the part below it:—

Whole =	12	19	17	24	15	21	18	16	40	50	60
Part =	6	5	8	11	12	9	4	13	20	10	40

14. Mary had 〰 cents in her pocket, but lost 〰 cents. By subtraction I find that she had only 〰 cents left.

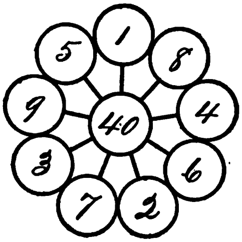
5.—For Practice in Subtraction.

	A	*B*	*C*	*D*	*E*
1.	1 from ·2	2 from 11	5 from ·9	7 from 13	1 from ·3
2.	1 from ·8	8 from 13	3 from ·7	9 from 10	2 from ·2
3.	1 from ·6	6 from 12	5 from ·7	8 from 15	4 from ·9
4.	1 from ·1	8 from 18	2 from ·4	5 from 14	8 from ·9
5.	6 from ·9	3 from 10	3 from ·6	6 from 11	5 from ·6
6.	2 from ·9	9 from 14	1 from ·4	9 from 15	7 from 11
7.	2 from ·6	8 from 11	4 from ·8	9 from 16	7 from 15
8.	2 from ·5	3 from 12	4 from ·5	2 from 10	5 from 10
9.	6 from ·7	9 from 17	1 from ·9	8 from 14	7 from 12
10.	6 from ·6	5 from 11	5 from ·8	4 from 13	7 from 10
11.	2 from ·3	1 from 10	2 from ·7	8 from 12	8 from 17
12.	4 from ·4	9 from 12	3 from ·3	4 from 10	9 from 20
13.	3 from ·4	5 from 13	3 from ·9	9 from 13	7 from 20
14.	7 from ·7	7 from 16	7 from ·8	3 from 11	8 from 20
15.	3 from ·5	6 from 15	4 from ·7	8 from 16	1 from 20
16.	1 from ·5	8 from 10	8 from ·8	9 from 18	5 from 20
17.	1 from ·7	5 from 12	3 from ·8	4 from 12	4 from 20
18.	5 from ·6	4 from 11	2 from ·2	9 from 11	6 from 20
19.	1 from ·3	6 from 14	4 from ·9	7 from 14	3 from 20
20.	8 from ·9	6 from 13	9 from ·9	6 from 10	2 from 20

Note.—**This table contains all the primary subtractions, and should be used until the pupil is proficient. Results may be given by columns or by lines. The dot or the 1 or the 2 in the minuend may be replaced by any figure, thus affording additional practice.**

1. Beginning with any circle, subtract the numbers in the circles successively from 40, or some other number at the center.

Thus, beginning at 1, we say 40 less 1 is 39; 39 less 8 is 31, and so on; give *results* only.



6.—Addition and Subtraction.

ORAL.

1. 9 cents + ∼ cents = 15 cents. **2.** 18 = 9 + ∼
3. Add 6, 4, 9, and 3. **4.** 7 out of a dozen leaves ∼
5. 20 − 9 + 4 = ∼ **6.** Count by 2's from 2 to 20.
7. How many out of 16 chickens died if only 7 lived?
8. 24 − 4 − 5 − 6 = ∼ **9.** Count backwards by 3's from 20.
10. Give quickly the sum of these numbers: —

6	10	12	18	6	10	12	23	41	20	16
8	9	5	4	17	20	10	9	6	20	9
—	—	—	—	—	—	—	—	—	—	—

11. Give their differences.
12. If Mary loses 16 cents of the 25 her mother gave her, how many will she have left?
13. Put 4, 6, 9, 8, and 5 together as one number.
14. Subtract 13 from 22, and what have you left?
15. James has 13 cents. How much more must he earn to have 25 cents?
16. One part of 23 is 9. What is the other part?
17. Emma had 19 cents; her mother gave her enough more to make 26 cents. How much did she give her?
18. Add 5 to each of these numbers: —

31, 29, 60, 32, 17, 95, 37, 86, 51, 22, 19.

19. 42 = 11 and ∼ **20.** 100 + 20 + 5 = ∼
21. April has 30 days. After 7 have gone there are ∼ more to come.
22. I bought berries for 10¢, and an orange for 4¢. I gave the merchant 25¢. How much did he return to me?
23. Edgar is 46 inches tall, and his sister is 38 inches. Tell the difference in their heights.
24. Take the difference between 4 and 16 from 31.
25. I went to a store with ∼ cents. I spent ∼ cents for apples, and ∼ cents for oranges. I had ∼ cents remaining.

7.—Addition and Subtraction.

WRITTEN.

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
4+	6+	8+	9+	4+	7+	8+	6+	7+	9+
6	2	4	6	7	8	4	5	3	8
9	9	9	6	6	9	2	5	6	9
8	7	5	5	8	8	9	4	4	8
3	3	2	10	9	10	7	3	9	9

11.	12.	13.	14.	15.	16.	17.	18.	19.
25	87	92	100	64	85	50	300	200
–6	–4	–7	–9	–21	–43	–30	–100	–80

	20.	21.	22.	23.	24.	25.	26.	27.	28.
Add	32	16	32	93	63	30	400	31	60
	45	22	47	16	91	70	200	102	147

---

1. Add 7, 6, 5, 4, 9, 2, and take away 8.
2. Add 32, 14, 20, 30, and subtract 9.
3. Add 232, 112, 213, 221, and subtract 111.
4. A farmer dug 98 bushels of potatoes. He sold 75 bushels. How many bushels did he keep?
5. One basket contains 72 apples, and another contains 23 apples. If you empty both baskets into a barrel, how many apples will it contain?
6. Take 4+7+8+9+2 away from 17+4+10.
7. On one side of George's slate there are 32 words, and on the other side 26 words. If he erases 6 words from one side, and 8 from the other, how many words remain on his slate?

8.—Multiplication and Division.

ORAL.

1. 1+1, or 2 ones are ⁓. 1+1+1, or 3 times 1 are ⁓. Four 1's are ⁓.
2. In 5 there are ⁓ 1's. 1 in 6 ⁓ times. 7 times 1 are ⁓. The sign × stands for the word **times.**
3. 8 times 1, or 8×1 are ⁓. 1 in 9 ⁓ times. 10 ones are ⁓.
4. How many 1's in 12? 15? 18? 20? 25? 60? 100?

1	2
2	
3	
4	
5	
6	
7	
8	
9	
10	

5. Which is more, 5¢ or 1 nickel? 10¢ or 1 dime?
6. 10 ones = ⁓ ten. 20 ones = ⁓ tens. 10×1 = ⁓.
7. Seven boys each put a cent into the slot to find out their weight. All together they put in ⁓ cents.
8. Count all these squares. There are ⁓ squares arranged in 10 rows of ⁓ each, or 2 columns with ⁓ squares in each column.
9. In 1 row there are 2 squares; in 2 rows there are ⁓ squares. 2+2 are ⁓. Two 2's are ⁓. 2×2 = ⁓.
10. In 4 squares there are ⁓ rows of 2 each. One half of 4 squares is ⁓. One half is written ½. ½ of 4 = ⁓.
11. In 3 rows there are ⁓ squares. 2+2+2 = ⁓. 3×2 = ⁓. □'s means squares. ½ of 6 □'s is ⁓.
12. 4×2 □'s = ⁓ □'s. 2+2+2+2 are ⁓. ⁓ □'s = ½ of 8 □'s.
13. Write *aa* 5 times. 5×2 *a*'s are ⁓ *a*'s. 5×2 = ⁓.
14. Five 2's put together, or 2 taken 5 times = ⁓.

Putting equal numbers together into one number is **Multiplication.**

The result of a multiplication is a **Product.**

15. Five girls each gave a blind beggar 2¢; he then had ⁓ cents, for five 2's put together are ⁓.
16. Multiply $2 by 5. The product of $2 multiplied by 5 is $⁓. 3×$2 are ⁓.

9.—Multiplication and Division by 2.

ORAL.

1. Six times 2 □'s are ⁓. 6 is ½ of ⁓. 6 × 2 = ⁓.
2. In a basket are 12 eggs. How many times can I take 2 eggs out? 2 can be taken out of 12 ⁓ times.
3. Fourteen □'s will make ⁓ rows of 2 each. 2 × 7 □'s are ⁓.
4. 2 □'s in 14 □'s ⁓ times. 2 pencils in 14 pencils ⁓.
5. Count by 2's to 16. How many 2's make 16? ⁓ × ⁓ = 16; ⁓ × ⁓ = 14; ⁓ × ⁓ = 12.
6. Take 18 objects; arrange them by 2's or in pairs. How many 2's in 18? 9 rows of □'s contain ⁓ □'s.
7. Separate 20 objects into equal parts of 2 each. ⁓ 2's = 20.

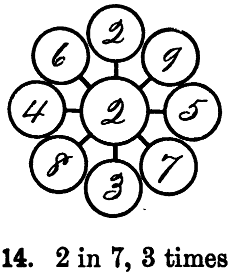
Separating a number into equal parts is **Division.**

The result of a division is a **Quotient.** Thus:—

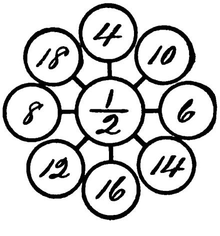
Separating $16 into 2 equal parts is finding ½ of $16, or dividing $16 by 2. The *quotient* of $16 divided by 2 is $8.

The **sign of division** is ÷; it means *divided by.*

8. $14 ÷ 2 = $⁓; $8 ÷ 2 = $⁓; ½ of 12¢ is ⁓; ½ of $20 is ⁓.
9. Count by 2's from 2 to 20, forward and back. In doing so you will give ten *multiples* of 2.
10. Draw the diagram on page 8, and fill the vacant squares with the multiples of 2.



11. Give the products at sight.
12. Give the quotients at sight.
13. ½ of 20; 40; 60; 80; 100; 120; 140; 160; 180; 200.



14. 2 in 7, 3 times and 1 remainder; 2 in 9; 2 in 11; 2 in 15.
15. Give quotients and remainders:—) means *in.*

2)12 2)13 2)19 2)17 2)21 2)24 2)25 2)18

10.—Multiplication and Division by 3.

1	2	3
2		
3		
4		
5		
6		
7		
8		
9		
10		

1. Here are ⁓ rows of □'s with ⁓ in a row. $3+3=$ ⁓. 2×3 □'s are ⁓. 2×3 are ⁓.

2. It takes ⁓ rows of 3 □'s to make 9 □'s. One third of 9 □'s is ⁓. One third is written $\frac{1}{3}$. 3 is $\frac{1}{3}$ of ⁓.

3. 3, 3, 3, and 3, or $4\times3=$ ⁓. 3 in 12 ⁓ times.

4. 5 rows of □'s contain ⁓ □'s. 5×3 are ⁓.

5. Which would you rather have, 5 3-cent pieces or 3 5-cent pieces? Why?

6. Put 6 times 3 eggs into a basket and there will be ⁓ eggs in the basket. Six 3's are ⁓. $\frac{1}{3}$ of 18 is ⁓.

7. One triangle has 3 sides; 6 triangles have ⁓ × 3 sides, or ⁓ sides.

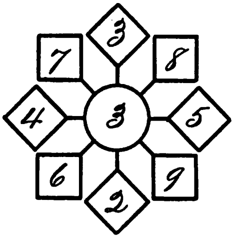
8. Seven triangles have ⁓ sides. $7\times3=$ ⁓; 7 is $\frac{1}{3}$ of ⁓.

9. If I draw 8 rows of □'s with 3 in a row, I shall have ⁓.

10. $\frac{1}{3}$ of 24 is ⁓; ⁓ $\times3=24$; 3 in 24 ⁓; $24\div3=$ ⁓.

11. $8\times3=24$; $24\div3=$ ⁓; $9\times3=$ ⁓; 9 is $\frac{1}{3}$ of ⁓.

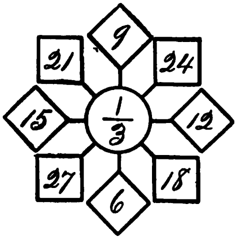
12. In one nest there are 3 eggs; in 10 nests there are 10×3 eggs, or ⁓ eggs. $10\times3=$ ⁓.



15. Multiply by 3.

13. Count forward and back by 3's from 3 to 30.

14. Draw the first diagram and fill the last column of squares with ten multiples of 3.



16. Divide by 3.

Fill the first blank with any number you choose.

17. When 1 orange costs 3 cents, ⁓ oranges will cost ⁓ × 3 cents, or ⁓ cents.

11.—Multiplication and Division.

WRITTEN.

1.	**2.**	**3.**	**4.**	**5.**	**6.**	**7.**
21+ 21	21 ×2	32+ 32	32 ×2	43+ 43	43 ×2	52 ×2

8.	**9.**	**10.**	**11.**	**12.**	**13.**	**14.**
23+ 23 23	23 ×3	33+ 33 33	33 ×3	42+ 42 42	42 ×3	62 ×3

15.	**16.**	**17.**	**18.**	**19.**	**20.**	**21.**
44+ 44	2)88	31+ 31	2)62	63+ 63	2)126	2)148

22.	**23.**	**24.**
51+51+51=∼ 153÷3=∼	62+62+62=∼ 186÷3=∼	83+83=∼ 166÷2=∼

Copy and add by columns and by lines:—

	1.	**2.**	**3.**	**4.**	**5.**	**6.**	**7.**	
14.	1+	2+	3+	1+	3+	3+	2	=∼
15.	2+	2+	3+	2+	3+	3+	2	=∼
16.	3+	3+	2+	3+	3+	3+	2	=∼
17.	2+	1+	3+	3+	2+	3+	2	=∼
18.	2+	3+	1+	1+	2+	3+	2	=∼

	8.	**9.**	**10.**	**11.**	**12.**	**13.**	
19.	2+	3+	2+	3+	4+	5	=∼
20.	4+	3+	3+	2+	3+	3	=∼
21.	6+	9+	3+	2+	3+	2	=∼
22.	2+	3+	1+	3+	2+	3	=∼
23.	2+	3+	3+	2+	3+	1	=∼

Copy and complete:—

25.	**26.**	**27.**	**28.**
$\frac{1}{3}$ of 18+2	6×2+4=∼	2×2×3=∼	27÷3×2=∼
∼×9=18	4×3÷2=∼	$\frac{1}{2}$ of 12×3=∼	24÷3+7=∼
∼ is $\frac{1}{3}$ of 21	18=∼×3	$\frac{1}{3}$ of 15×2=∼	$\frac{1}{2}$ of 12=$\frac{1}{3}$ of ∼
3 in 29	$\frac{1}{3}$ of 27+8=∼	6 is $\frac{1}{3}$ of 2×∼	3×3×2=∼

12.—Writing Numbers.

1. In writing numbers we use ⁓ figures. **2.** The names of the ten figures are ⁓. **3.** The largest number that can be written with one figure is ⁓. **4.** To write numbers larger than nine we use ⁓ or more ⁓ placed side by side.

A figure used alone or in the *first* right-hand place stands for so many **ones**; as 3 = 3 ones.

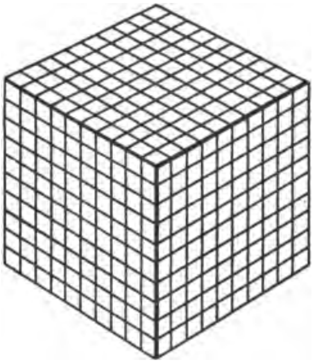
Used in the *second* place a figure stands for so many **tens**; 30 = 3 tens; 33 = 3 tens + 3 ones.

A figure in the *third* place stands for **hundreds**; 300 = 3 hundreds; 333 = 3 hundreds + 3 tens + 3 ones.

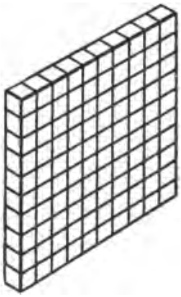
A figure in the *fourth* place stands for **thousands**; 3000 = 3 thousands; 3 thous. + 3 hund. + 3 tens + 3 ones = 3,333.

5. Tell what the separate figures stand for in

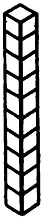
62 84 964 8391 1648 5840
85 96 327 4672 4476 1600
119 234 426 6893 5908 2803



10 hundreds,
1 thousand,
1000.



10 tens,
1 hundred,
100.



10 ones,
1 ten,
10.

1 one.

1.

6. 10 ones = 1 ⁓; 10 tens = 1 ⁓; 10 hundreds = 1 ⁓

7. 37 = 3 tens + 7 ones 287 = ⁓ + ⁓ + ⁓ 84 = 7 tens + 14 ones

8. 26 = ⁓ + ⁓ 354 = ⁓ + ⁓ + ⁓ 65 = 5 tens + ⁓

9. 75 = ⁓ + ⁓ 659 = ⁓ + ⁓ + ⁓ 93 = 8 tens + ⁓

13.—Addition.

WRITTEN.

1. How many *ones* equal one *ten?* How many tens = 1 hundred?
2. In 19 how many tens and ones? In 37? 49?
3. In 140 how many hundreds and tens? In 260?
4. 18 + 4 + 7 = ⁓ tens + ⁓ ones. 9 + 6 + 7 + 8 = ⁓ + ⁓.
5. 30 + 60 + 50 = 140 = ⁓ hundred + ⁓ tens.
6. Find the sum of $357, $864, $928.

$$\begin{array}{r} \$357 \\ 864 \\ 928 \\ \hline \$2149 \end{array}$$

Method. It is more convenient to write the numbers so that the *ones* will come in the same column.

The sum of the ones is 19 ones, or 1 ten 9 ones; we write the 9 ones and add the 1 ten with the column of tens, making 14 tens, or 1 hundred 4 tens; we write the 4 tens and add the 1 hundred with the column of hundreds, making 21 hundreds, which we write in the proper place. The sum is $2149.

To test our work we may add downwards from the top as well as upwards from the bottom.

Add the following numbers by columns and lines: —

	7.	8.	9.	10.
15.	247 +	329 +	408 +	629
16.	325 +	476 +	307 +	883
17.	642 +	893 +	614 +	472

	11.	12.	13.	14.
18.	839 +	894 +	845 +	371
19.	641 +	376 +	684 +	988
20.	329 +	921 +	932 +	847

	21.	22.	23.	24.
29.	649 +	468 +	583 +	891
30.	832 +	327 +	673 +	39
31.	964 +	946 +	200 +	846
32.	821 +	827 +	14 +	218
33.	832 +	375 +	6 +	94

	25.	26.	27.	28.
34.	849 +	418 +	418 +	478
35.	63 +	72 +	698 +	329
36.	2 +	385 +	994 +	864
37.	968 +	61 +	397 +	327
38.	327 +	378 +	861 +	985

39. How many scholars in the Washington School if there are 8 rooms, and 52 scholars in each room?

14. — Money.

ORAL.

The smallest coin that we use is the **cent.**

A **nickel** = 5 cents.
A **dime** = 10 cents.
A **dollar** = 100 cents.

A **quarter** of a dollar = 25 cents.
A **half**-dollar = 50 cents.
$ means *dollars;* ¢ means *cents.*

When we write dollars and cents together, we put a period called a *decimal point* between them. Thus: —

$3.25 is 3 dollars and 25 cents.

1. Read $1.25; $1.50; $2.75; $3.24; $4.50; $6.95; $0.75; $0.68.
2. 2 nickels = ∼ cents; 15 cents = ∼ nickels.
3. 2 dimes = ∼ cents, or ∼ nickels; $1 = ∼ quarters.
4. 1 dime + 2 nickels = ∼ cents; 3 dimes = ∼ cents.
5. Sarah gave the grocer 2 dimes to pay for 12 cents' worth of sugar; he should give her back ∼ cents.
6. 1 dime + 3 nickels = ∼ cents, or ∼ nickels.
7. The three coins that make 25¢ are 2 ∼ and a ∼.
8. When I pay for 17 cents' worth of salt with a silver quarter, I should receive ∼ back in change.
9. 10¢ + 5¢ + 5¢ + 5¢ = ∼; 25¢ + 25¢ = ∼ ¢; ∼ 25's = 50.
10. How many silver quarters would you give for a half-dollar?
11. Out of a quarter take a dime and a nickel. What is left?
12. Add a quarter, 2 dimes, and a nickel.
13. $1. = ∼¢; $2. = ∼; $3. = ∼; $5. = – ; $½ = – ; $¼ = –.
14. $3.25 – twenty-five cents = ∼ $1.50 – $½ = ∼
15.

$2.25	$1.12	$5.00	$3.75	$1.10	$6.50
+2.00	+2.14	+5.00	−1.75	+1.15	−6.50

16. How many cents in a dollar? How many half-dollars?
17. How many quarters? Dimes? Nickels? $½ = ∼ dimes.

16.—Subtraction.

ORAL AND WRITTEN.

1. One part of 16 is 5, and the other part is ⁓.
2. 7 and ⁓ = 13; 13 − ⁓ = 6; 26 − 5 = ⁓; 400 = 100 + ⁓.
3. Taking part of a number out of it to find the remainder is ⁓.

The number from which a part is taken in Subtraction is the **Minuend.** The part taken away is the **Subtrahend,** and the part left is the **Remainder.** Of course the two parts put together make the minuend. Thus: —

Minuend − subtrahend = remainder.	
15 − 9 = 6	378 = minuend.
15 = 9 + 6	132 = subtrahend.
25 − 12 = 13	246 = remainder.
25 = 12 + 13	132 + 246 = 378.

4. One part of 898 is 624; find the other part; prove it.
5. The whole of my money = $800; one part of it = $200; the rest = ⁓.
6. The minuend = 456; the subtrahend = 223; remainder = ⁓.
7. Subtract 37 from 93.

$$\begin{array}{ll} 93=80+13 & 93 \\ \underline{37=30+\ 7} & \underline{37} \\ 56=50+\ 6 & 56 \end{array}$$

Method. As 7 ones cannot be taken from 3 ones, we change 1 of the 9 tens to 10 ones, and put it with the 3 ones, making 13 ones; 7 ones from 13 ones = 6 ones. After taking the 1 ten from the 9 tens, 8 tens were left; 3 tens from 8 tens = 5 tens. The remainder is 5 tens + 6 ones, or 56.

	From	take		From	take		From	take		From	take
8.	73	48	**12.**	182	68	**16.**	382	176	**20.**	864	358
9.	52	27	**13.**	281	75	**17.**	476	218	**21.**	327	119
10.	45	39	**14.**	322	119	**18.**	694	486	**22.**	630	525
11.	91	56	**15.**	461	253	**19.**	783	666	**23.**	741	33

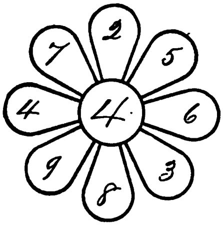
24. A gentleman who had $692 gave away $279. How much had he left?

16.—Multiplication and Division by 4.

ORAL.

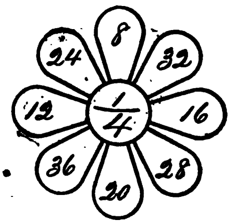
1	2	3	4
2			
3			
4			
5			
6			
7			
8			
9			
10			

1. In one row there are 4 ☐'s. In 2 rows there are ~ ☐'s. Two 4's are ~; 2 in 8; 4 in 8; $\frac{1}{2}$ of 8; $\frac{1}{4}$ of 8.
2. 4+4+4= ~; 3 fours are ~; 3 × 4 = ~.
3. 8= ~ 4's; 12= ~ 4's; 16= ~ 4's; 20= ~ 4's. In one row are ~ ☐'s; in 5 rows 5 × ~ ☐'s or ~ ☐'s.
4. 4+4; 8+4; 12+4; 16+4; four 4's are ~; five 4's= ~.
5. $\frac{1}{4}$ of 8; $\frac{1}{4}$ of 12; $\frac{1}{4}$ of 16; $\frac{1}{4}$ of 20; 2 is $\frac{1}{4}$ of ~; 4 is $\frac{1}{4}$ of ~; 5 is $\frac{1}{4}$ of ~.
6. In 6 rows there are ~ ☐'s; for 6 rows contain ~ times as many as one row. 6 × 4 ☐'s= ~ ☐'s.
7. After each of 6 boys has put 4 pears into a basket, it will have ~ pears in it.
8. If I should give the pears to four girls, each girl would have ~ pears, for $\frac{1}{4}$ of 24 pears= ~.
9. Count 28 ☐'s. How many rows have you counted? 28= ~ 4's. ~ × ~ are 28.
10. 7 fours are ~; 28+4= ~; 8 fours= ~; 8 × 4= ~.
11. 9 × 4 ☐'s are ~ ☐'s; 9 is $\frac{1}{4}$ of ~; 4 × 9= ~; ~ ÷ 4=9.
12. Ten 4's are ~; $\frac{1}{4}$ of 40= ~; ~ is $\frac{1}{4}$ of 28; ~ is $\frac{1}{4}$ of 36.



13. Draw a diagram of squares and write the multiples of 2, 3, and 4.

14. When one lemon costs ~ cents, 4 lemons will cost ~ × ~ cents, or ~ cents. Fill the first blank as you please.



15. Multiply by 4.

16. Divide by 4.

17. — Multiplication and Division.

ORAL.

1. Learn and recite the following table of

Liquid Measures.

4 gills (gi.) are 1 pint (pt.).
2 pints " 1 quart (qt.).
4 quarts " 1 gallon (gal.).

2. Mention 4 liquids sold by a grocer.
3. One pint contains 4 gills; 3 pints contain ⁓ times ⁓ gills or ⁓. 8 pt. are ⁓ × ⁓ gills or ⁓ gills.
4. 2 pints make 1 quart; 18 pints make ⁓ quarts, for there are ⁓ 2's in 18.
5. One gallon is 4 quarts, 6 gallons are ⁓ times ⁓ quarts, or ⁓ quarts. 11 gal. = ⁓ quarts.
6. With a gallon measure I can dip out ⁓ quarts at a time; to dip out 28 quarts I should have to dip ⁓ times, for there are ⁓ 4's in 28.
7. It takes ⁓ pints to make a quart, and ⁓ pints to make a gallon.

8.

1 pt. = ⁓ gi.
2 pt. = ⁓ gi.
3 pt. = ⁓ gi.
5 pt. = ⁓ gi.
⁓ pt. = 16 gi.
⁓ pt. = 24 gi.

9.

2 pt. = ⁓ qt.
4 pt. = ⁓ qt.
3 qt. = ⁓ pt.
6 qt. = ⁓ pt.
16 pt. = ⁓ qt.
12 qt. = ⁓ pt.

10.

1 gal. = ⁓ qt.
2 gal. = ⁓ qt.
4 gal. = ⁓ qt.
12 qt. = ⁓ gal.
20 qt. = ⁓ gal.
7 gal. = ⁓ qt.

11.

6 pt. = ⁓ gi.
3 qt. = ⁓ pt.
8 gal. = ⁓ qt.
20 gi. = ⁓ pt.
24 pt. = ⁓ qt.
40 qt. = ⁓ gal.

12. Out of a 4-gallon cask of vinegar I can fill ⁓ gallon jugs, or ⁓ 2-quart jugs, or ⁓ quart bottles.

18.—Practice with Liquid Measures.

ORAL.

1. Jennie's mug holds a gill of milk. She can fill it ∼ times out of a pint cup, for a pint contains ∼ gills.
2. Our cow gives a gallon of milk. This will fill a quart bowl ∼ times, or a pint bowl ∼ times.
3. If a vinegar cruet holds a gill, Mary can fill it ∼ times out of a quart (or ∼ pints or ∼ gills).
4. When we burn a pint of oil every night, a gallon will last us ∼ nights, for there are ∼ pints in a gallon.
5. If we take 1 quart of milk a day, in 28 days we shall have taken ∼ quarts or ∼ gallons.
6. When a gallon of oil costs 12 cents, a quart, or $\frac{1}{4}$ of a gallon, will cost $\frac{1}{4}$ of ∼, or ∼.
7. At a cent a gill, a pint of milk will cost ∼ cents, and a quart will cost ∼ times as much, or ∼.
8. When a gallon of oil costs 12 cents, a quart, which is $\frac{1}{4}$ of a gallon, will cost ∼ of ∼ cents, or ∼.
9. When oil is 16 cents a gallon, a quart will cost ∼ cents, because ∼.
10. At 2 cents a pint, a quart will cost ∼ × 2 cents, or ∼.
11. When milk is 3 cents a pint, with 18 cents I can pay for ∼ pints. $18 \div 3 =$ ∼.
12. In $\frac{1}{2}$ of a gallon there are ∼ quarts. $\frac{1}{2}$ of ∼ $= 2$.
13. Eleven pints of oil, at 2 cents a pint, will cost ∼ cents. If I give the grocer a quarter of a dollar, he will give me ∼ cents back.
14. $2\frac{1}{2}$ gallons = ∼ quarts; $3\frac{1}{4}$ gallons = ∼ quarts.
15. What will 2 gal. and 2 qt. of milk cost at 12 cents a gallon?
16. I paid 48 cents for vinegar at 12 cents a quart. How many gallons did I buy?
17. What will $1\frac{1}{2}$ gallons of milk cost at 7 cents a quart?
18. 2 gal. + 8 qt. = ∼ **19.** 7 qt. + 8 pt. = ∼

19.—Subtraction.

WRITTEN.

1. We find the *sum* of several numbers by —.
2. By — we find the *remainder* when part of number is taken out of it.
3. What shall I put with 231 to make 432?
4. Subtract 356 from 648.

648 = 500 + 140 + 8 648 = minuend.
356 = 300 + 50 + 6 356 = subtrahend.
292 = 200 + 90 + 2 292 = remainder.

Method. 6 ones from 8 ones, 2 ones; 5 tens cannot be taken from 4 tens, so out of the 6 hundreds we take 1 hundred, change it to 10 tens and put it with the 4 tens, making 14 tens; 5 tens from 14 tens = 9 tens; 3 hundreds from 5 hundreds = 2 hundreds. Remainder, 292.

We can test our work by seeing whether 356+292 will equal 648.

5. 647 − 556
6. 876 − 692
7. 943 − 552
8. 842 − 391
9. 365 − 184
10. 474 − 292
11. 827 − 645
12. 564 − 372
13. 981 − 468
14. 283 − 85
15. 945 − 639
16. 632 − 521
17. 785 − 318
18. 841 − 649
19. 3412 − 516
20. 6421 − 827
21. 1283 − 349
22. 6832 − 684
23. 951 − 327
24. 8329 − 849
25. 6213 − 847
26. $2.47 − $1.29
27. $2.46 − $1.50
28. $3.94 − $2.78
29. $5.88 − $1.75
30. $6.75 − $3.39
31. $5.24 − $4.88
32. $3.91 − $2.89

33. From the sum of 324 and 576 take 324.
34. Take 876 from the sum of 762 and 649.
35. What remains of $3.75 after $1.64 has been spent?
36. One part of $3.94 is $1.51; find the other part.
37. Put together $1.59, $6.24, $8.37, and $5.62.
38. 369 + 542 + 387 + 921 − 849 = —.
39. 4783 − 927 − 342 − 871 = —.
40. $4.76, $2.57, and $1.75 are the three parts of what?
41. Edward received $8.32 at one time, and $1.65 at another. He paid out $4.19. What had he left?
42. Take the sum of all the subtrahends in examples 26 to 32 from the sum of all the minuends.

20.—Writing Numbers in Letters.

Seven letters are sometimes used in writing numbers. They are called *Roman Numerals*, and are

I	V	X	L	C	D	M
1	5	10	50	100	500	1000

Other numbers are written by using two or more of these letters together. Thus:—

Ones.	**Tens.**	Tens + Ones.
1=I.	10=X.	10+2=X.+II.=XII.=12.
2=II.	20=XX.	20+3=XX.+III.=XXIII.=23.
3=III.	30=XXX.	30+4=XXX.+IV.=XXXIV.=34.
4=IV.	40=XL.	40+5=XL.+V.=XLV.=45.
5=V.	50=L.	50+6=L.+VI.=LVI.=56.
6=VI.	60=LX.	60+7=LX.+VII.=LXVII.=67.
7=VII.	70=LXX.	70+8=LXX.+VIII.=LXXVIII.=78.
8=VIII.	80=LXXX.	80+9=LXXX.+IX.=LXXXIX.=89.
9=IX.	90=XC.	90+5=XC.+V.=XCV.=95.
10=X.	100=C.	100+6=C.+VI.=CVI.=106.

1. Read the following numbers of chapters in a book:—

XI. XXV. XXXI. XLVI. LXXXV.
XIV. XXVII. XXXV. LVIII. LXXXVI.
XVI. XXIX. XXXVI. LXXI. XCVIII.

2. Write the following numbers in Roman Numerals:—

15, 17, 23, 36, 45, 53, 69, 74, 86, 97, 108.

Roman Numerals are chiefly used in numbering chapters and on clocks. Once in a while we see the number of the year written in this way. Thus:—

1895 is written MDCCCXCV.

M + D + CCC + XCV = MDCCCXCV.
1000 + 500 + 300 + 95 = 1895.

21.—For Practice in Addition and Subtraction.

	K.	*L.*	*M.*	*N.*	*O.*	
a.	$1.25	$2.54	$3.75	$94.69	$56.78	**a.**
b.	2.34	4.56	4.36	68.92	57.69	**b.**
c.	5.23	6.31	5.14	71.48	85.57	**c.**
d.	4.35	5.64	2.36	47.73	56.89	**d.**
e.	1.15	4.65	7.65	66.65	79.86	**e.**
f.	2.33	2.53	4.58	65.39	67.58	**f.**
g.	3.54	6.36	9.76	58.27	59.98	**g.**
h.	4.45	5.56	8.91	82.59	36.95	**h.**
i.	5.44	4.63	2.67	23.49	76.86	**i.**
j.	3.42	5.41	4.53	49.73	47.57	**j.**

To the Teacher. **The above table will furnish exercises for practice. Each direction below gives five exercises. Thus for exercise 1 the pupil will add the first five numbers in column *K*, for exercise 2, five numbers in *L*, etc.; for exercises 6 to 10 he will add the five numbers in each column, beginning with e, and so on.**

No. of Exercises. Add all the numbers in each column from

1– 5. **a** to **f.**
6–10. **e** to **j.**
11–15. **j** to **d.**
16–20. **a** to **h.**
21–25. **c** to **j.**
26–30. **a** to **i.**
31–35. **j** to **c.**
36–40. **i** to **a.**
41–45. **a** through **j.**

No. of Exercises. Add all the numbers in lines

46. **a** and **b.**
47. **b** and **c.**
48. **c** and **d.**
49. **d** and **e.**
50. **e** and **f.**
51. **f** and **g.**
52. **g** and **h.**
53. **h** and **i.**
54. **i** and **j.**

Subtraction.

No. of Exercises. In each column find the difference between

1– 5. **a** and **b.**
6–10. **b** and **c.**
11–15. **c** and **d.**
16–20. **d** and **e.**
21–25. **e** and **f.**
26–30. **f** and **g.**
31–35. **g** and **h.**
36–40. **h** and **i.**
41–45. **i** and **j.**
46–50. **a** and **c.**
51–55. **b** and **d.**
56–60. **h** and **j.**

22.—Multiplication and Division by 5.

ORAL.

1. Here are 〰 rows of □'s with 〰 in a row. In 2 rows there are 〰 □'s. Two 5's are 〰.

1	**2**	**3**	**4**	**5**
2				10
3				15
4				20
5	10	15	20	25
6				30
7				35
8				40
9				45
10				50

2. Two 5 cent pieces are the same as 〰 cents or 〰 dime. 5 is $\frac{1}{2}$ of 〰; $2 \times 5 =$ 〰.

3. 3 rows of □'s contain 〰 □'s. 5 in 15 〰 times.

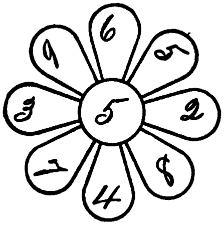
4. If a pound of meat costs 15 cents, $\frac{1}{3}$ of a pound will cost $\frac{1}{3}$ of 〰 or 〰. $\frac{1}{3}$ of $15 =$ 〰.

5. 4×5 are 〰. 20 □'s make 〰 rows when there are 5 in a row. Four quarts of milk at 5 cents a quart will cost 〰 cents. For 20 cents I can get 〰 oranges at 5 cents each. One fifth of 20 is 〰. $\frac{1}{5}$ of 20 is 〰.

6. Five 5's are 〰. I can prove that this is true by 〰〰 the □'s. $\frac{1}{5}$ of 25 is 〰; $\frac{2}{5}$ of $25 = 2 \times$ 〰 or 〰.

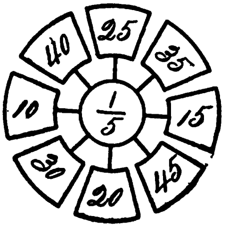
7. Count 6 rows of □'s. $6 \times 5 =$ 〰. If I put 30 chickens into 6 coops, there may be 〰 in each coop. $\frac{1}{6}$ of $30 =$ 〰.

8. 5, 5, 5, 5, 5, 5, and 5 are 〰. $7 \times 5 =$ 〰. Count by 5's to 35. When Nellie gets one more nickel, she will have 35 cents. So she must already have 〰 nickels.



9. 8 rows contain 〰 □'s. $8 \times 5 =$ 〰. $\frac{1}{5}$ of 〰 $= 8$.

10. $40 + 5 =$ 〰. $45 =$ 〰 5's. $9 \times 5 =$ 〰. 45 cents will pay for 〰 quarts of milk at 5 cents a quart.



11. Give products quickly. **12.** Give quotients quickly.

23.—Multiplication.

WRITTEN.

1. Put six 5's together into one product, and we have ∼∼. Ten nickels together make ∼∼ cents, or a ∼∼.
2. Putting equal numbers together into one product is ∼∼.

Copy and complete the following:—

3.

$2\times2=4$

$2\times30=60$

$2\times\underline{100}=\underline{200}$

$2\times132=$ ∼∼

4.

$3\times3=9$

$3\times20=60$

$3\times\underline{200}=\underline{600}$

$3\times$ ∼∼ $=$ ∼∼

5.

$4\times1=$ ∼∼

$4\times20=$ ∼∼

$4\times\underline{200}=$ ∼∼

$4\times$ ∼∼ $=$ ∼∼

6.

$4\times4=16$

$4\times20=80$

$4\times\underline{300}=\underline{1200}$

$4\times324=$ ∼∼

7.

$5\times3=$ ∼∼

$5\times40=$ ∼∼

$5\times\underline{200}=$ ∼∼

$5\times243=1215$

8.

$5\times435=$ ∼∼

$5\times5=$ ∼∼

$5\times30=$ ∼∼

$5\times400=$ ∼∼

9. Put 435, 435, 435, 435, and 435, or five 435's, together, or, in other words, multiply 435 by 5.

ADDITION.

$$\begin{array}{r}435\\435\\435\\435\\\underline{435}\\2175\text{ sum.}\end{array}$$

MULTIPLICATION.

$$\begin{array}{rl}435&=\text{multiplicand.}\\\underline{5}&=\text{multiplier.}\\2175&=\text{product.}\end{array}$$

Method. 5 × 5 ones = 25 ones, 2 tens 5 ones; write the 5 ones; 5×3 tens=15 tens; adding the 2 tens (of the 25 ones), we have 17 tens, 1 hundred 7 tens; write the 7 tens; 5×4 hundreds=20 hundreds; adding the 1 hundred (of the 17 tens), we have 21 hundreds, which we write in the product. Product=2175.

10. 2×217
11. 3×325
12. 4×234
13. 5×631
14. 2×582
15. 3×637
16. 2×721
17. 4×319
18. 3×864
19. 5×978
20. 5×829
21. 3×947
22. 2×678
23. 4×897
24. 5×762

24. — Review.

ORAL.

Use one of the following numbers to fill the first blank below, and then solve the problem: —

3, 7, 5, 8, 9, 6, 4, 2, 5, 10.

1. When 1 quart of milk costs 5 cents, ⁓ quarts will cost ⁓ times 5 cents, or ⁓ cents.
2. What will 4 oranges cost at 3¢ each?
3. At 5¢ a pound, what will 9 pounds of rice cost?
4. What will 9 yards of lace cost at 4¢ a yard?
5. At $2 a bushel, what will 7 bushels of wheat cost?
6. What will 7 yards of cloth cost at $5 a yard?

Use one of these numbers to fill the first blank: —

16, 12, 20, 8, 24, 36, 40, 28, 32.

7. When 4 pounds of sugar cost ⁓ cents, 1 pound will cost $\frac{1}{4}$ of ⁓ cents, or ⁓ cents.
8. 4 quarts of oil cost 28¢. What will 1 quart cost?
9. What will 1 pt. of milk cost when 5 pt. cost 50¢?
10. 3 yards of silk cost $18. What will one yard cost?
11. What will 1 pound of nails cost when 5 pounds cost 35¢?
12. 5 peaches cost 25¢. What will 1 cost?

Use one of these numbers to fill the first blank: —

10, 20, 15, 35, 40, 25, 30, 45, 50.

13. When 5 pints of oil cost ⁓ cents, one pint will cost $\frac{1}{5}$ of ⁓ cents, or ⁓ cents; 3 pints will cost 3 × ⁓ cents, or ⁓ cents.
14. 2 pounds of sugar cost 12¢. What will 3 pounds cost?
15. What will 5 loaves cost when 4 loaves cost 24¢?
16. What will 4 pencils cost when 5 pencils cost 30¢?
17. 5 qt. of milk cost 10¢. What will 4 qt. cost?
18. What will 5 books cost when 4 books cost 20¢?

25. — Review.

ORAL.

1. Give first the sums, and then the differences of

12	9	17	24	13	19	36	15	16	44	29	51	26	35	49	73
6	12	8	9	7	2	7	7	8	20	8	7	3	20	8	7

2. Give products rapidly.

9	7	8	6	3	5	9	4	10	8	5	9	6	3	2	4	7	6	5	7	9
2	3	4	5	3	4	5	2	4	3	5	2	3	5	4	4	3	5	4	4	3

3. Give quotients rapidly.

4)40 4)28 5)35 4)16 5)20 4)24 3)18
4)32 4)36 5)45 5)50 3)21 3)9 3)12

4.* $30 \div 5, \times 4, -5, -1, \div 3, \times 5$.
5. $45 \div 5, \times 3, -3, \div 3, \times 4, +9$.
6. $8 \times 3, +10, -2, \div 4, \times 5$.
7. 6, 7, and what are 21?
8. $6+7+\sim=20$.
9. $60-10, \div 10, \times 9, -5$.

WRITTEN.

1. Albert earned $3.72 in a week, and Edward earned $2.89. They put their money together and bought a velocipede. What did it cost?
2. A farmer sheared 525 sheep in 2 weeks; the first week he sheared 278. How many did he shear in the second week?
3. Six hundred ninety-four children are in a certain school; 398 are girls. How many are boys?
4. Add together $\frac{1}{2}$ of 16, $\frac{1}{3}$ of 27, $\frac{1}{4}$ of 32, $\frac{1}{5}$ of 45, and 3×8.
5. 78 cattle are in one drove, and 4 times as many in another. How many cattle are there in all?
6. 837 gallons of water are in a tank, but 395 gallons leak out. How many gallons remain?
7. Take 5×89 away from 4×135.

---

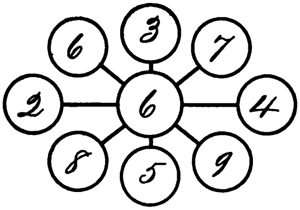
* We use the comma to show that the operations indicated by the signs are to be performed in the order in which they come from left to right.

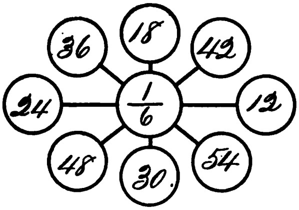
26.—Multiplication and Division by 6.

ORAL.

1	2	3	4	5	6
2					12
3					18
4					24
5					30
6	12	18	24	30	36
7					42
8					48
9					54
10					60

1. How many squares are here shown? There are ∼ rows with ∼ in a row.
2. In 2 rows there are 6 + 6 or ∼ □'s.
3. 2 × 6 = ∼. 6 in 12? One sixth of 12?
4. 3 rows contain ∼ □'s. 3 × 6 = ∼. $\frac{1}{6}$ of 18 = ∼.
5. 6, 6, 6, and 6 are ∼. 4 × 6 = ∼.
6. 24 □'s = ∼ rows. $\frac{1}{6}$ of 24 is ∼.
7. $\frac{1}{6}$ of 24 is ∼. $\frac{2}{6}$ of 24 = 2 × ∼ or ∼.
8. 5 rows of □'s = ∼ □'s. ∼ 6's in 30.
9. 30 ÷ 6? $\frac{1}{6}$ of 30? $\frac{2}{6}$ of 30? $\frac{3}{6}$ of 30?
10. Count by 6's to 36. How many 6's make 36? $\frac{1}{6}$ of 36?
11. 7 rows of □'s are ∼. 7 × 6 = ∼. $\frac{1}{6}$ of 42? $\frac{2}{6}$ of 42?
12. 7 × 6, + 6 = ∼. 48 = ∼ 6's. ∼ × ∼ = 48. $\frac{1}{6}$ of 48 = ∼.
13. 9 × 6 = 48 + 6 or ∼. 54 = ∼ × 6. ∼ is $\frac{1}{6}$ of 54.
14. In 10 rows of □'s there are ∼ □'s. 10 × 6 = ∼. $\frac{1}{6}$ of 60?
15. Count by 6's from 6 to 60 and from 60 to 6.
16. Draw the diagram above and fill its squares with the multiples of 2, 3, 4, 5, and 6.
17. Give products quickly.
18. Give quotients quickly.





19. $\frac{1}{6}$ of 18 + $\frac{1}{6}$ of 24 = ∼
20. $\frac{1}{6}$ of 30 + $\frac{1}{6}$ of 36 = ∼
21. $\frac{1}{6}$ of 42 from $\frac{1}{6}$ of 54 = ∼
22. 10 is $\frac{1}{6}$ of ∼ and 3 is $\frac{1}{6}$ of ∼
23. $\frac{24}{6}$ means the same as 6 in 24. $\frac{48}{6}$ = ∼. $\frac{72}{6}$ = ∼.

27.—Multiplication and Division by 6.

ORAL.

1. Mr. Ward put six 5-dollar bills into his pocket-book. How much did it then contain?
2. Putting equal numbers together into one number is ∼.

One of the equal numbers is called the **Multiplicand.** The number that shows how many equal numbers are to be put together is the **Multiplier.** The result of a multiplication is the **Product.**

3. In 6 × $5 = $30, $5 is the multiplicand, 6 is the multiplier, and $30 is the ∼.
4. Multiplicand = 9 yards; multiplier = 6; product = ∼.
5. A keg holds 72 gallons. How many 6-gallon jugs will it fill?
6. In a dairy are 8 six-quart pans of milk. How large a can will they fill?
7. 8 and 4 and 10 sixes are how many?
8. Take 6 away from 9 sixes and ∼ remains.
9. At 6 for 1 cent, what will 42 apples cost?
10. 60 minutes are 1 hour; $\frac{1}{6}$ of an hour = ∼ minutes.
11. 9 is $\frac{1}{6}$ of ∼; 8 is $\frac{1}{6}$ of ∼; 12 is $\frac{1}{6}$ of ∼; 60 = ∼ × 6.
12. Mary wrote 24 words and misspelled $\frac{1}{6}$ of them. How many did she have right?
13. Out of a class of 48 boys, $\frac{1}{6}$ are absent. How many are at school?
14. When 1 comb costs 6¢, 7 combs will cost 7 × 6¢, or ∼.
15. When 6 combs cost 36¢, 1 comb will cost $\frac{1}{6}$ of 36¢, or ∼.
16. If you can earn \$6 a week, what can you earn in 4 weeks?
17. At 6¢ each, what will 9 spools of silk cost?
18. $\frac{1}{6}$ of 54 is ∼. In 54 days how many weeks of 6 working-days each?
19. I bought ∼ pounds of sugar at 6¢ a pound, and gave the trader a half-dollar. How much did he return to me?

28.—Multiplication and Division by 6.

ORAL.

1. Add $\frac{1}{6}$ of 18 and $\frac{1}{6}$ of 24.
2. $60 \div 6 = 10$. 60, the number to be divided, is the **Dividend**; 6, the number by which we divide, is the **Divisor**; 10, the result of the division, is the **Quotient.**
3. $48 \div 6 =$ ⁓. The dividend is ⁓, the divisor is ⁓, and the quotient is ⁓.
4. The dividend is 24, the divisor is 6, the quotient is ⁓.
5. The divisor is 6, the dividend is 30, the quotient is ⁓.
6. Divisor = 6, dividend = 66, quotient = ⁓.
7. The sign) is used to show that the number after it is to be divided by the number before it; it is read *in*. The quotient is written under the dividend. Give the quotients.

$6\underline{)30}$ $6\underline{)48}$ $6\underline{)54}$ $6\underline{)72}$ $6\underline{)60}$ $6\underline{)18}$ $6\underline{)24}$ $6\underline{)66}$

8. There are 54 seats in a schoolroom, in 6 rows. How many seats in a row?
9. Five pigeons cost 60 cents. What will 6 pigeons cost?
10. Six jars hold 18 quarts. What will 10 jars hold?
11. A dozen eggs are 12 eggs; doz. stands for dozen. $\frac{1}{2}$ doz. = ⁓. $\frac{1}{3}$ doz. = ⁓. $\frac{1}{4}$ doz. = ⁓. $\frac{2}{3}$ doz. = ⁓. $\frac{3}{4}$ doz. = ⁓.
12. A doz. eggs cost 20 cents. What will $\frac{1}{2}$ doz. cost? $\frac{1}{4}$ doz.?
13. How many boxes will hold 54 pencils, 6 in a box?
14. $\frac{1}{6}$ of \$72? $\frac{1}{6}$ of 72 girls? $\frac{1}{6}$ of 18 quarts? $\frac{1}{6}$ of 36 pounds?
15. 5 is $\frac{1}{6}$ of ⁓. 7 is $\frac{1}{6}$ of ⁓. 4 is $\frac{1}{6}$ of ⁓. 10 is $\frac{1}{6}$ of ⁓.
16. 6 apples cost 5 cents; 12 apples, or 2 times 6 apples, will cost ⁓ times 5 cents, or ⁓ cents.
17. At the same price, what will 18 apples cost? 24 apples? 42 apples? 60 apples?
18. Find the cost of 8 sponges at 6 cents each.

Fill the first blank with any multiple of 6:—

18. When 6 pounds of sugar costs ⁓ cents, 1 pound will cost $\frac{1}{6}$ of ⁓ cents, or ⁓ cents.

29.—Multiplication and Division.

WRITTEN.

1.	2.	3.	4.	5.	6.
21+	32+	45+	63+	75+	98+
21	32	45	63	75	98
21	32	45	63	75	98
21	32	45	63	75	98
21	32	45	63	75	98
21	32	45	63	75	98
6 × 21=	6 × 32=	6 × 45=	6 × 63=	6 × 75=	6 × 98=

Find the products of these numbers, and add them:—

7.	8.	9.	10.	11.
4 × 30=	3 × 40=	2 × 60=	4 × 50=	5 × 80=
5 × 30=	5 × 40=	4 × 60=	6 × 50=	6 × 80=
6 × 30=___	6 × 40=___	6 × 60=___	5 × 50=___	4 × 80=___

Find the difference between these products:—

12.	13.	14.	15.	16.
6 × 70=	5 × 52=	4 × 64=	6 × 38=	5 × 79=
3 × 70=___	2 × 52=___	6 × 64=___	5 × 38=___	6 × 79=___

17. 6 × 9, + 13, − 23, × 5, − 18. **19.** 6 × 14, − 42, ÷ 7, × 9, − 21.
18. 6 × 8, + 27, − 19, + 86, − 23. **20.** 6 × 35, − 70, + 83, − 17, + 51.

Add these quotients:—

21.	22.	23.	24.	25.
50 ÷ 5=	$\frac{1}{6}$ of 36=	42 ÷ 6=	$\frac{1}{5}$ of 45=	4 in 80=
27 ÷ 3=	$\frac{1}{5}$ of 40=	35 ÷ 5=	$\frac{1}{3}$ of 18=	3 in 120=
16 ÷ 8=___	$\frac{1}{4}$ of 28=___	48 ÷ 6=___	$\frac{1}{6}$ of 24=___	6 in 66=___

26. Add $2.35, $6.41, $5.25, $3.07, and one dollar and a half.
27. Take $1.75 out of five dollars and a quarter.
28. What will 6 pairs of shoes cost at $1.25 a pair?
29. I had $54 and spent $\frac{1}{6}$ of it. What had I left?

30.—Multiplication and Division by 7.

ORAL.

1. In 1 row there are 7 □'s; in 2 rows there are ⁓ □'s.

2. Make 2 rows of 7 *a*'s.

3. Count them by 2's. 7 × 2 = ⁓.

4. 2 + 2 + 2 + 2 + 2 + 2 + 2 = 7 + 7.

5. 7 × 2 = 2 × 7. 14 = ⁓ 2's or ⁓ 7's.

6. We have learned that 7 × 3 = ⁓.

7. In 3 rows there are ⁓ □'s. 3 × 7 □'s = ⁓ □'s. 7 × 3 = 3 × 7.

8. In 4 rows of 7 □'s each there are ⁓ □'s. In 7 columns of 4 □'s each there are ⁓ □'s. Add 7 fours; add 4 sevens.

9. 28 = 7 × ⁓ or ⁓ × 7; $\frac{1}{4}$ of 28 = ⁓. $\frac{1}{7}$ of 28 = ⁓.

10. In one week there are 7 days; in 4 weeks there are ⁓ × 7 days or ⁓ days.

1	2	3	4	5	6	7
2						14
3						21
4						28
5						35
6						42
7	14	21	28	35	42	49
8						56
9						63
10						70

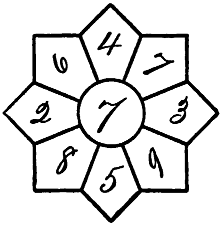
11. In February there are 28 days or ⁓ weeks; $\frac{1}{7}$ of 28 = ⁓.

12. 5, 5, 5, 5, 5, 5 and 5 added = ⁓; 7, 7, 7, 7 and 7 added = ⁓. 7 × 5 = ⁓, and ⁓ × 7 also = ⁓; $\frac{1}{5}$ of 35 = ⁓; 7 in 35 ⁓.

13. 7 × \$6 = \$42; 6 × \$7 = ⁓; 42 ÷ 6 = ⁓; 42 ÷ 7 = ⁓.

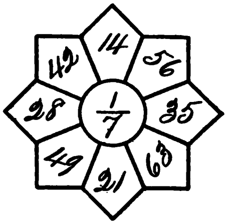
14. Seven rows of 7 □'s contain ⁓ □'s; 7 × 7 = ⁓.

15. 8 × 7 □'s = ⁓ □'s; 56 = ⁓ 7's; $\frac{1}{7}$ of 56 = ⁓; ⁓ × 7 = 56; 8 weeks = ⁓ days.



16. Count 63 □'s. How many rows in 63 □'s? ⁓ × 7 = 63; $\frac{1}{7}$ of 63 = ⁓.

17. Count by 7's to 70. 70 = 10 ⁓; $\frac{1}{7}$ of 70 is ⁓; 7 × 10 = 10 × ⁓.



18. Give products at sight.

19. Give quotients at sight.

31.—Multiplication and Division.

ORAL.

a. Draw the diagram and fill the squares with the multiples of 2, 3, 4, 5, 6, and 7.

b. Make a division table beginning at 7 in 7, 1, and ending with 7 in 70, 10.

c. Divide the following numbers by 7, giving quotients and remainders first by columns and then by lines:—

	A.	*B.*	*C.*	*D.*	*E.*	*F.*	*G.*	*H.*	*I.*	*J.*
1.	7	35	14	28	42	21	70	49	63	56
2.	8	38	16	32	43	24	75	53	69	59
3.	11	40	18	29	46	22	72	50	64	62
4.	13	36	15	33	44	27	71	54	66	60
5.	9	39	19	30	47	23	74	51	68	61
6.	12	41	17	34	45	25	73	55	65	58
7.	10	37	20	31	48	26	76	52	67	57

WRITTEN.

8. Putting several equal numbers together into one product is ——.

If each of 3 boys gives me 32 cents, I shall have in all —— × 32 cents or —— cents.

$$\begin{array}{r} 32 \text{ cents} \\ \times 3 \\ \hline 96 \text{ cents} \end{array}$$

9. Separating a number into equal parts is ——.

If I should divide 96 cents equally among 3 boys, I should have to separate the money into 3 equal parts and give each boy $\frac{1}{3}$ of —— cents, or —— cents.

$$\begin{array}{r} 3\overline{)96} \text{ cents} \\ \hline 32 \text{ cents} \end{array}$$

Method. 96 = 9 tens + 6 ones. We say $\frac{1}{3}$ of 9 tens is 3 tens, which we place under the 9; $\frac{1}{3}$ of 6 ones is 2 ones, which we put under the 6. Quotient = 32 cents.

Separate the following numbers into equal parts:—

10. $63 into 3 parts.
11. 84 books into 4 piles.
12. 186 boys into 6 groups.
13. 546 cents into 6 parts.
14. 427 sticks into 7 piles.
15. $637 into 7 parts.

32. — Multiplication and Division.

ORAL.

1. 〰 × 〰 = 35; 〰 × 〰 = 42; 〰 × 〰 = 18; 〰 × 〰 = 27; 〰 × 〰 = 70.
2. Take $\frac{1}{6}$ of 36 from $\frac{1}{7}$ of 49. 〰 is $\frac{1}{5}$ of 45.
3. 1 week contains 〰 days; 8 weeks contain 〰 days.
4. 63 days are 〰 weeks, for 63 contains 〰 7's.
5. How many quarts in 1 gallon? In 7 gallons?
6. At 7 cents a pound, 9 pounds of sugar cost 〰 cents.
7. Seven nickels will buy as much as 〰 cents.
8. Forty-five cents are equal to 〰 dimes and 〰 nickel.
9. Bought 4 cakes of soap at 7¢ each. I must give the storekeeper a quarter of a dollar and 〰 cents.
10. A horse-car makes 7 trips a day. To make 56 trips will require 〰 days. 56 ÷ 7 = 〰.
11. How much less than a half-dollar will 9 papers of tacks cost at 5 cents each? 50 − 45 = 〰.
12. Fred Hale can ride 10 miles an hour on his bicycle. In 6 hours he can ride 〰 miles.
13. Add $\frac{1}{4}$ of 16 to $\frac{1}{7}$ of 42. 〰 × 〰 = 63.
14. $\frac{1}{7}$ of 28 is 〰. $\frac{2}{7}$ of 28 will be 〰 times 〰, or 〰.
15. If pins are 6¢ a paper, how many papers can you buy for 5 nickels?
16. Will a half-dollar just pay for 7 yards of cotton at 7 cents a yard?
17. What will a 7-pound fish cost at 9¢ a pound?
18. See how quickly you can give the following quotients: —

$\frac{35}{7}$ $\frac{36}{6}$ $\frac{49}{7}$ $\frac{42}{6}$ $\frac{48}{6}$ $\frac{50}{5}$ $\frac{28}{7}$ $\frac{28}{4}$ $\frac{9}{3}$ $\frac{63}{7}$ $\frac{54}{6}$

19. Fill the blanks first with 1 and then with 2, 3, 4, 5, 6, and give results quickly. Thus, 5 × 7 are 35, and 1 is 36.

5 × 7, + 〰   7 × 7, + 〰   4 × 7, + 〰   0 × 7, + 〰
3 × 7, + 〰   2 × 7, + 〰   6 × 7, + 〰   1 × 7, + 〰
10 × 7, + 〰   9 × 7, + 〰   8 × 7, + 〰   7 × 7, + 〰

33.—Miscellaneous.

WRITTEN.

1. Give the sum, difference, product, and quotient of 6 and 18; 5 and 45; 7 and 56; 4 and 28; 7 and 63.

2. How much would you have in all if you should receive $1.35, $7.28, $3.16, $4.72, and $1.45?

3. Together Mary and Ellen have $2.15. If Mary has $1.08, how much has Ellen?

4. Pour 7 pails of water into a tub. What will it contain if each pail holds 15 quarts?

5. Separate 147 pencils into 7 equal bundles. What will each contain?

Add these products and quotients:—

6.	**7.**	**8.**	**9.**	**10.**	**11.**
23×7	66×7	83×7	89×7	$217 \div 7$	$637 \div 7$
45×7	75×7	88×7	97×7	$357 \div 7$	$567 \div 7$

12. $\frac{1}{7}$ of $49 + \frac{1}{7}$ of $63 + \frac{1}{7}$ of $28 + \frac{1}{7}$ of $56 + \frac{1}{7}$ of $70 =$ what?

13. $\frac{1}{3}$ of $24 + \frac{1}{4}$ of $36 + \frac{1}{5}$ of $45 + \frac{1}{6}$ of $48 + \frac{1}{7}$ of $21 =$ what?

14. How shall we find $\frac{1}{3}$ of 78?

$$\begin{array}{r} 3\overline{)78} \\ \hline 26 \end{array}$$

Method. $78 = 7$ tens $+ 8$ ones, or 6 tens $+ 18$ ones. $\frac{1}{3}$ of 6 tens $= 2$ tens; $\frac{1}{3}$ of 18 ones $= 6$ ones. So $\frac{1}{3}$ of $78 = 2$ tens $+ 6$ ones, or 26.

In dividing, we say 3 in 7 2 times and 1 remaining; 3 in 18 6 times. Quotient 26.

15. $\frac{1}{2}$ of 32
16. $\frac{1}{3}$ of 45
17. $\frac{1}{4}$ of 56
18. $\frac{1}{5}$ of 65

19. 4 in 64
20. 5 in 75
21. 6 in 84
22. 7 in 91

23. $72 \div 4$
24. $95 \div 5$
25. $96 \div 6$
26. $98 \div 7$

27. 2)116
28. 3)138
29. 4)176
30. 6)252

31. Divide the sum of 26, 44, and 93 by 3.

32. Divide 6 times 49 by 7.

33. $5 \times 35, +91, -70, \div 7$.

34. $637 - 574, \div 7, \times 6, +218$.

35. $455 \div 7, \times 5, -28$.

36. $\frac{1}{6}$ of $372 + \frac{1}{7}$ of 504.

37. $4 \times \frac{1}{7}$ of 658.

34.—Multiplication and Division by 8.

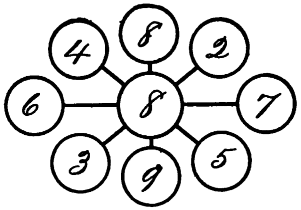
. ORAL.

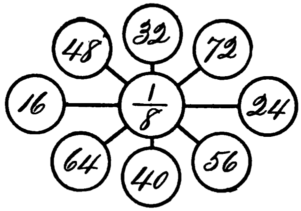
1	2	3	4	5	6	7	8
2							16
3							24
4							32
5							40
6							48
7							56
8	16	24	32	40	48	56	64
9							72
10							80

1. Here are 〰 rows of □'s with 〰 □'s in each row.
2. In 2 rows there are 2 times 8 □'s, or 16 □'s. 2 × 8 are 〰.
3. 16 ÷ 8 = 〰; $\frac{1}{8}$ of 16 is 〰.
4. Three 8's are 〰; I find this by counting, or by adding, for 8 + 8 + 8 = 〰.
5. $\frac{1}{3}$ of 24 is 〰; $\frac{1}{8}$ of 24 is 〰; 〰 is $\frac{1}{3}$ of 24.
6. Four rows of □'s contain 〰 □'s; 8 + 8 + 8 + 8 = 〰; 4 × 8 □'s = 〰 □'s; 8 in 32 〰; 〰 is $\frac{1}{8}$ of 32.
7. I have learned that 8 × 5 are 〰; so of course 5 × 8 are 〰; 5 rows of 8 each are the same as 8 columns of 5 each. $\frac{1}{5}$ of 40 is 〰; $\frac{1}{8}$ of 40 is 〰; 8 nickels = 〰¢.
8. 5 × 8 are 〰; 6 × 8 will be one 8 more, or 〰. Which is larger, 8 × 6 or 6 × 8? $\frac{1}{8}$ of 48 □'s = 〰 □'s.
9. Count 7 rows of □'s. 7 × 8 □'s = 〰 □'s. $\frac{1}{8}$ of 56 is 〰.
10. Eight rows of desks with 7 in each row are 〰 desks. $\frac{1}{7}$ of 56 is 〰. To get 56 I must add 〰 8's.
11. 64 − 56 = 〰; 56 + 〰 = 64; 7 × 8 = 〰; 8 × 8 = 〰. $\frac{1}{8}$ of 48 is 〰; $\frac{1}{8}$ of 56 is 〰; $\frac{1}{8}$ of 64 is 〰; 8)64 = 〰.
12. 9 rows of □'s with 8 in a row make 〰 □'s; 9 × 8 are 〰.
13. 9 × 8 are 〰; 72 + 8 are 〰; 10 × 8 □'s are 〰; $\frac{1}{8}$ of 80 is 〰.
14. Count by 8's from one 8 to ten 8's and back.
15. Draw 80 squares with 8 in a row, and fill the squares with the multiples of 2, 3, 4, 5, 6, 7, 8.
16. Make a division table from 8)8 to 8)80.

35.—Multiplication and Division.

ORAL.





1. Multiply by 8.
2. Divide by 8.
3. Multiply each of the following numbers by 8 and add 1 to the product. Give the last result only.

1	5	7	4	9	2	6	8	10	3

4. Multiply by 8 and add 2; add 3; add 4; add 5.
5. Multiply by 8 and add 6; add 7; add 8.
6. Divide the following numbers by 8, giving quotients and remainders, first by columns and then by lines:—

	A.	*B.*	*C.*	*D.*	*E.*	*F.*	*G.*	*H.*	*I.*	*J.*
1.	8	40	56	32	72	16	48	64	80	24
2.	9	43	58	35	73	18	52	65	84	28
3.	12	41	61	37	77	21	49	69	87	29
4.	14	46	60	33	75	17	53	66	83	25
5.	10	42	59	38	79	22	50	70	86	30
6.	13	45	63	34	76	19	54	67	82	26
7.	11	47	62	39	74	23	51	71	85	31
8.	15	44	57	36	78	20	55	68	81	27

WRITTEN.

9. 79+79+79+79+79+79+79+79=what?

10. 8×62
11. 74×8
12. $248 \div 8$
13. $728 \div 8$
14. $\frac{1}{8}$ of 328
15. 8×327
16. $37 \times 8, -119$
17. $32 \times 6, \div 8$
18. $\frac{1}{8}$ of 592, $\times 3$

36.—Multiplication and Division.

Dry Measures. We measure dry articles like potatoes, oats, and corn by the *peck* or *bushel.*

1 peck = 8 quarts.
1 bushel (bu.) = 4 pecks (pk.).

1. In 1 pk. there are 〰 qt.; in 2 pk. there are 2 × 〰 qt., or 〰.
2. 3 pk. = 3 × 〰 qt.; 4 pk. = 4 × 〰 qt.; 5 pk. = 〰 qt.
3. $\frac{1}{2}$ pk. = 〰 qt.; $\frac{1}{4}$ pk. = 〰 qt.; $1\frac{1}{2}$ pk. = 〰 qt.
4. At 8¢ a pound, 6 pounds of sugar will cost 6 × 〰 ¢, or 〰 ¢. 8 pounds will cost 〰 ¢.
5. How many pecks in a bushel? A basket that holds 3 bu. holds 〰 pk.
6. $\frac{1}{8}$ of 56 is 〰. 〰 × 〰 = 64; 〰 × 〰 = 72.
7. I paid $48 for 8 tons of coal. This was 〰 dollars a ton. 8 × $6 = $〰. When a ton costs $6, 7 tons cost 〰.
8. There are 〰 8's in 32. 4 pk. = 〰 qt.
9. $\frac{1}{8}$ of 72 is 〰; $\frac{2}{8}$ of 72 = 2 × 〰, or 〰; $\frac{3}{8}$ of 72 = 〰.
10. 40 gallons will fill an 8-gallon jug 〰 times.
11. $\frac{1}{8}$ of 72 cents added to $\frac{1}{8}$ of 32 cents = 〰 cents.
12. With a silver quarter I can buy 〰 pounds of sugar at 8 cents a pound, and have 〰 left.
13. Henry sold 2 qt. of milk for 16 cents; that was 〰 cents a quart. He ought to get 〰 cents for 10 quarts.
14. $\frac{1}{8}$ of 56 less $\frac{1}{8}$ of 32 is 〰. 6 times $\frac{1}{2}$ of 16 is 〰.
15. A dime, a nickel, and a quarter = 〰 cents.
16. When 3 pineapples cost 24¢, 1 will cost $\frac{1}{3}$ of 24¢, or 〰 ¢, and 7 will cost 〰 × 〰 ¢, or 〰 ¢.

Fill the first blank with any multiple of 8.

17. When 8 pounds of rice cost 〰 cents, 1 pound will cost $\frac{1}{8}$ of 〰 cents, or 〰 cents; 7 pounds will cost 〰 × 〰 cents, or 〰 cents.

37. — Miscellaneous.

WRITTEN.

Copy and complete these exercises: —

1.	2.	3.	4.
6 × 〰 = 48	24 − 〰 = 15	8 × 〰 = 72	〰 × 〰 = 28
54 ÷ 6 = 〰	7 × 〰 = 42	〰 ÷ 8 = 10	36 = 〰 × 〰
8 is $\frac{1}{8}$ of 〰	〰 × 〰 = 63	〰 − 16 = 9	63 ÷ 7 = 〰
7 in 〰 = 4	〰 − 8 = 31	5 is $\frac{1}{6}$ of 〰	$\frac{1}{?}$ of 15 is 3
19 + 〰 = 26	$\frac{1}{7}$ of 63 = 〰	8 is $\frac{1}{?}$ of 32	$\frac{2}{5}$ of 20 is 〰

Add these products and quotients: —

5.	6.	7.	8.
7 × 80 =	8 × 80 =	168 ÷ 8 =	630 ÷ 7
6 × 70 =	8 × 90 =	200 ÷ 5 =	720 ÷ 8
8 × 40 =	7 × 60 =	246 ÷ 6 =	648 ÷ 8
5 × 90 =	6 × 90 =	490 ÷ 7 =	637 ÷ 7

Find the difference between these products and quotients: —

9.	10.	11.	12.
4 × 29 =	6 × 94 =	648 ÷ 8 =	78 × 8 =
88 ÷ 8 =	728 ÷ 8 =	287 ÷ 7 =	65 × 6 =

1. 8 × 273
2. 8 × 456
3. 8 × 78
4. 8 × 99
5. 512 ÷ 8
6. 584 ÷ 8
7. 776 ÷ 8
8. $\frac{1}{7}$ of 595
9. 764 − 636, ÷ 8
10. 988 − 116, ÷ 8
11. 349 + 427, ÷ 8
12. 45 × 8, × 7
13. $\frac{1}{6}$ of 144
14. $\frac{1}{8}$ of 144
15. $\frac{1}{4}$ of 144
16. $\frac{1}{7}$ of 343

17. If you receive 18¢, 25¢, 34¢, and 28¢, and spend 3 dimes, how many cents shall you have left?

18. What will 8 horses cost when one horse costs $137?

19. 776 apples are in 8 baskets. How many are there in each basket?

38.— Multiplication and Division by 9.

ORAL.

1	2	3	4	5	6	7	8	9
2								18
3								27
4								36
5								45
6								54
7								63
8								72
9	18	27	36	45	54	63	72	81
10								90

1. Count the squares at the left. How many are there?

2. How many in each row? How many rows? Ten times 9 are how many?

3. Two rows of □'s are ⁓ □'s. 2 × 9 = ⁓; 9 in 18 ⁓; $\frac{1}{9}$ of 18 is ⁓.

4. Three 9's, or 9 + 9 + 9 = ⁓. 27 ÷ 9 = ⁓; 3 × 9 = ⁓; $\frac{1}{9}$ of 27 = ⁓.

5. In 4 rows there are ⁓ □'s. I can prove this by counting. When I add four 9's I get ⁓. 36 ÷ 9 = ⁓; 36 ÷ 4 = ⁓; 4 × 9 = ⁓.

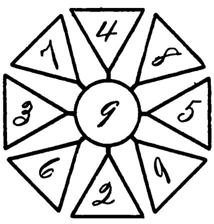
6. 5 × 9 □'s = ⁓ □'s. Five lines of *a*'s with 9 in a line would be ⁓ *a*'s. 45 ÷ 9 = ⁓. $\frac{1}{9}$ of 45 = ⁓.

7. 54 = ⁓ × 9. $\frac{1}{9}$ of 54 □'s is ⁓ □'s. 6 × 9 = 9 × ⁓, or ⁓.

8. 6 × 9 = 54; 54 + 9 = 63; 7 × 9 = ⁓. Seven slates at 9¢ each would cost 7 × 9¢, or ⁓ ¢.

9. Count 8 rows of □'s. 8 × 9 □'s are ⁓ □'s. How many 9's in 72? $\frac{1}{8}$ of 72 is ⁓, and $\frac{1}{9}$ of 72 is ⁓.

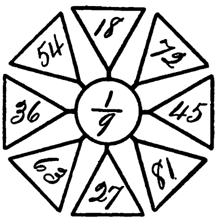
10. Nine × 9 □'s are ⁓ □'s; $\frac{1}{9}$ of 81 is ⁓. **⁓ × ⁓ = 81.**



13. Multiply by 9.

11. 10 × 9 = ⁓. $\frac{1}{9}$ of 90 is ⁓. If I divide 90 cents among 9 girls, each girl will have ⁓ cents.

12. Draw 90 squares and fill them with the multiples you have learned.



14. Divide by 9.

39. — Multiplication and Division by 9.

ORAL PRACTICE WORK.

a. Fill the ⁓ with 1, 2, 3, 4, 5, 6, 7, 8, 9 in succession, and give results quickly. Thus: 5 times 9 are 45 and 1 is 46.

5 × 9, + ⁓
3 × 9, + ⁓
10 × 9, + ⁓
7 × 9, + ⁓
2 × 9, + ⁓
9 × 9, + ⁓
4 × 9, + ⁓
6 × 9, + ⁓
8 × 9, + ⁓
5 × 8, + ⁓
1 × 9, + ⁓
7 × 9, + ⁓

b. Divide these numbers by 9, first by columns and then by lines, giving quotients and remainders: —

	A.	*B.*	*C.*	*D.*	*E.*	*F.*	*G.*	*H.*	*I.*	*J.*
1.	9	90	18	54	81	63	45	36	72	27
2.	10	95	22	58	82	68	46	37	77	36
3.	14	91	25	59	87	64	51	40	81	31
4.	11	96	19	55	83	69	47	44	76	35
5.	15	92	23	60	88	65	52	38	80	30
6.	12	97	26	63	84	70	48	41	75	34
7.	16	93	20	56	89	66	53	42	79	29
8.	13	98	24	61	85	71	49	39	74	33
9.	17	94	27	62	90	67	54	43	78	28
10.	18	99	21	57	86	72	50	45	73	32

WRITTEN.

11. to **20.** Add the above columns. **21** to **30.** Add each line.

Copy and complete the following: —

31.

⁓ × ⁓ = 63
9 × ⁓ = 54
2 × 3 × 3 =
$\frac{1}{7}$ of 49 is ⁓
8 is $\frac{1}{7}$ of ⁓

32.

72 ÷ 9 =
45 ÷ ⁓ = 9
⁓ × ⁓ = 64
37 + 18 =
63 − 17 =

33.

9 × 7, + 9, ÷ 9 =
8 × 8, − 8, ÷ 8 =
9 × 8, − 9, ÷ 9 =
7 × 7, + 1, ÷ 5 =
$\frac{1}{5}$ of 35, × 9 =

34.

2 × 2, × 2, × 9 =
81 ÷ 9, × 7, + 4 =
8 is $\frac{1}{6}$ of ⁓
9, + 9, + 9, + 9, ÷ 9 =
63 − 7, ÷ 8, + 7 =

40.—Multiplication and Division by 9.

ORAL.

1. The sides of a triangle are each 9 inches long; the distance around the triangle is ⁓ inches. 3 × 9 inches are ⁓.
2. Each side of a square is 9 inches long; the distance around it is ⁓ times 9 inches, or ⁓ inches.
3. With twenty cents I can buy ⁓ 9-cent books and have ⁓ cents left. ⁓ × 9, + ⁓ = 20.
4. Fill the first ⁓ with 2, 3, 4, 5, 6, 7, 8, or 9. When rice costs 9 cents a pound, for ⁓ pounds I must pay ⁓ × 9 cents, or ⁓ cents.
5. $\frac{1}{9}$ of 72 + $\frac{1}{8}$ of 64 are ⁓; 6 is $\frac{1}{9}$ of ⁓.
6. If my pail holds 9 gallons, I must carry ⁓ pailfuls to fill a barrel holding 81 gallons.
7. How many quarts in a peck? In 9 pecks?
8. I know there are ⁓ days in 9 weeks, because 9 weeks contain 9 × as many days as ⁓.
9. Charles is 9 years old, and his father is 4 times as old; so his father must be ⁓ years old.
10. Add seven 9's together, and we have ⁓.
11. Take 4 × 8 from 36, and ⁓ will be left.
12. Fill the first blank with 27, 36, 54, 63, 81, 72, or 45.
    When milk is 9¢ a quart, for ⁓ cents I can buy ⁓ quarts, for there are ⁓ 9's in ⁓.
13. $\frac{1}{9}$ of 18 is ⁓; $\frac{2}{9}$ of 18 = 2 × ⁓, or ⁓; $\frac{5}{9}$ of 18 = ⁓.
14. When a suit of clothes cost $9, how many suits can be bought for $72?
15. 2 pecks = ⁓ quarts; 2½ pecks = ⁓ quarts.
16. When 9 apples cost 5 cents, 6 times as many apples, or 54 apples, will cost ⁓ × 5 cents, or ⁓.

    Fill the third blank with 2, 3, 4, 5, 7, 8, 9, or 10, as you may choose:—
17. When 6 apples cost 54¢, 1 apple will cost ⁓ of 54¢, or ⁓ ¢; ⁓ apples will cost ⁓ × ⁓ ¢, or ⁓ ¢.

41.—Miscellaneous Exercises.

WRITTEN.

1. Put $1.72, $3.87, $4.95, $3.87, and $2.75 together into one sum.
2. Find the remainder when $3.67 is taken out of $8.41.
3. When 87 quarts is the multiplicand and 9 is the multiplier, what is the product?
4. What is the quotient when 9 is the divisor and $864 is the dividend?

5.	6.	7.	8.	9.
$2.89+	$6.75+	$1.23+	$0.97+	$7.89+
3.89	5.76	2.45	1.45	7.89
4.89	7.65	3.67	2.09	7.89
5.89	6.57	4.89	1.37	7.89
3.98	7.56	5.78	3.29	7.89

10.	11.	12.	13.	14.
$4.28	$3.91	$6.42	$11.84	$6.21
−3.76	−1.38	−2.75	−8.95	−5.17

15.	16.	17.	18.	19.
$235.	$467.	$859.	$475.	$832.
×7	×8	×9	×9	×8

20.	21.	22.	23.	24.
9)342	9)486	9)594	9)693	9)873

Copy and complete the following:—

25.	26.	27.	28.
$\frac{1}{9}$ of 54 × 8 =	$2\frac{1}{2}$ × 10 =	$\frac{1}{8}$ of 64, × $\frac{1}{5}$ of 25 =	⁓ × ⁓ = 63
16 + 23, ÷ 3 =	4 × 9, + $\frac{1}{8}$ of 64 =	$\frac{1}{3}$ of 27, ÷ 3, × 6 =	⁓ × ⁓ = 48
20 × $\frac{1}{8}$ of 40 =	100 − 37, + 4 =	64 ÷ 8, ÷ 2, × 9 =	⁓ × ⁓ = 81
200 × 2, ÷ 4 =	100 + ⁓ = 178	7 × 7, + 6, ÷ 9 =	⁓ × ⁓ = 49
8 is $\frac{1}{9}$ of ⁓	81 ÷ ⁓ = 9	36 ÷ 9, × 6, ÷ 8 =	⁓ + ⁓ = 23
5 × 9, − 9, ÷ 4 =	$\frac{1}{7}$ of 63 + 5, ÷ 2 =	⁓ is $\frac{1}{9}$ of 72	⁓ ÷ ⁓ = 9

42.—Multiplication and Division by 10.

ORAL.

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
2	4	6	8	10	12	14	16	18	20
3	6	9	12	15	18	21	24	27	30
4	8	12	16	20	24	28	32	36	40
5	10	15	20	25	30	35	40	45	50
6	12	18	24	30	36	42	48	54	60
7	14	21	28	35	42	49	56	63	70
8	16	24	32	40	48	56	64	72	80
9	18	27	36	45	54	63	72	81	90
10	20	30	40	50	60	70	80	90	100

1 × 10 □'s =
2 × 10 □'s =
3 × 10 □'s =
4 × 10 □'s =
5 × 10 □'s =
6 × 10 □'s =
7 × 10 □'s =
8 × 10 □'s =
9 × 10 □'s =
10 × 10 □'s =

1. How many cents in a dime? In 3 dimes? In 5? In 7?
2. How many dimes in 20¢? In 30¢? In 50¢? In 80¢?
3. At 10¢ a gallon, 7 gallons of oil will cost ⁓.
4. For 90¢ I could buy ⁓ collars at 10¢ each. $\frac{1}{10}$ of 90 is ⁓.
5. $\frac{1}{10}$ of 80 + $\frac{1}{7}$ of 49 = ⁓. 8 × 8 from 7 × 10 = ⁓.
6. In 1 dime there are ⁓ cents; in 10 dimes there are 10 × ⁓ cents, or ⁓ cents. **100 cents = $1.00.**
7. A dime is ⁓ of a dollar. $\frac{8}{10}$ of a dollar = ⁓ cents. $\frac{5}{10}$ of $1 = ⁓ cents. $\frac{1}{2}$ = ⁓ cents.
8. Mary bought 6 yards at 8¢ a yard. How much change should she receive if she gave the storekeeper 5 dimes?
9. How many *ones* in 7 *tens?* In 7 *tens* + 8 *ones ?*
10. 1 *hundred* = ⁓ tens. 10 *tens* + 5 *tens* + 6 *ones* = ⁓.
11. How many tens and ones in 64, 18, 48, 73, 92, 87, 105?
12. 3 × 10, + 6 ÷ 4
13. 4 × 10, + 8 ÷ 6
14. 6 × 10, − 4 ÷ 7
15. 9 × 8, + 8, ÷ 10
16. 6 × 7, − 2, ÷ 4
17. 9 × 7, + 1, ÷ 8
18. 13 + 17, ÷ 10, × 9
19. 26 + 14, ÷ 10, × 8
20. $\frac{1}{10}$ of 90, × 9

43. — Practice in Multiplication.

ORAL.

a. Without filling the 〰 give products by lines or columns.

b. Fill the 〰 with 1, 2, 3, 4, 5, 6, 7, 8, or 9, as the teacher may direct, and give the results by lines or by columns.

	A.	*B.*	*C.*	*D.*
1.	2 × 2 + 〰	3 × 6 + 〰	7 × 9 + 〰	10 × 10 + 〰
2.	4 × 7 + 〰	3 × 4 + 〰	10 × 1 + 〰	6 × 9 + 〰
3.	7 × 8 + 〰	2 × 8 + 〰	9 × 4 + 〰	9 × 7 + 〰
4.	6 × 1 + 〰	3 × 3 + 〰	8 × 8 + 〰	5 × 8 + 〰
5.	4 × 10 + 〰	7 × 5 + 〰	2 × 6 + 〰	4 × 3 + 〰
6.	10 × 2 + 〰	5 × 9 + 〰	3 × 9 + 〰	3 × 8 + 〰
7.	6 × 8 + 〰	9 × 3 + 〰	7 × 7 + 〰	10 × 7 + 〰
8.	8 × 5 + 〰	5 × 6 + 〰	2 × 3 + 〰	3 × 5 + 〰

	E.	*F.*	*G.*	*H.*
9.	3 × 7 + 〰	6 × 4 + 〰	7 × 7 + 〰	9 × 1 + 〰
10.	10 × 5 + 〰	7 × 3 + 〰	8 × 7 + 〰	5 × 5 + 〰
11.	9 × 6 + 〰	4 × 5 + 〰	4 × 2 + 〰	4 × 1 + 〰
12.	5 × 4 + 〰	9 × 2 + 〰	7 × 6 + 〰	8 × 3 + 〰
13.	8 × 6 + 〰	2 × 1 + 〰	10 × 8 + 〰	10 × 9 + 〰
14.	2 × 10 + 〰	4 × 9 + 〰	8 × 1 + 〰	9 × 8 + 〰
15.	7 × 10 + 〰	9 × 9 + 〰	5 × 10 + 〰	6 × 10 + 〰
16.	6 × 3 + 〰	6 × 7 + 〰	3 × 2 + 〰	4 × 8 + 〰

	I.	*J.*	*K.*	*L.*
17.	9 × 9 + 〰	10 × 4 + 〰	3 × 1 + 〰	6 × 6 + 〰
18.	2 × 5 + 〰	6 × 5 + 〰	2 × 9 + 〰	2 × 7 + 〰
19.	5 × 2 + 〰	5 × 1 + 〰	10 × 3 + 〰	8 × 9 + 〰
20.	7 × 6 + 〰	9 × 10 + 〰	7 × 2 + 〰	3 × 10 + 〰
21.	10 × 6 + 〰	9 × 7 + 〰	9 × 5 + 〰	4 × 4 + 〰
22.	6 × 2 + 〰	7 × 4 + 〰	7 × 8 + 〰	5 × 7 + 〰
23.	7 × 1 + 〰	5 × 3 + 〰	8 × 4 + 〰	9 × 6 + 〰
24.	8 × 10 + 〰	8 × 2 + 〰	2 × 4 + 〰	4 × 6 + 〰

44.—Practice in Division.

ORAL.

Give quotients either by lines or columns:—

	A.	*B.*	*C.*	*D.*	*E.*	*F.*	*G.*
1.	6)42	2)8	6)18	10)90	6)60	10)30	8)56
2.	3)27	2)2	6)24	8)40	9)9	9)27	2)20
3.	4)36	4)16	4)20	2)18	7)14	8)16	3)6
4.	6)12	5)15	7)42	9)72	9)18	5)20	3)24
5.	7)56	7)28	3)3	5)35	8)8	7)7	8)80
6.	6)54	7)35	5)10	10)80	4)28	4)12	5)25
7.	10)100	2)16	8)64	5)45	6)30	2)6	2)10
8.	3)30	3)21	10)50	4)24	3)18	5)40	9)54
9.	8)48	6)54	9)81	3)12	4)8	7)49	5)50
10.	6)48	10)60	2)4	7)70	2)14	3)15	10)10
11.	9)63	4)32	6)36	7)21	10)40	10)70	4)40
12.	9)45	3)9	8)24	9)36	9)90	7)35	5)30
13.	8)24	8)72	2)12	5)5	4)4	5)35	7)63
14.	10)20	8)32	7)63	6)6	8)72	8)72	9)63

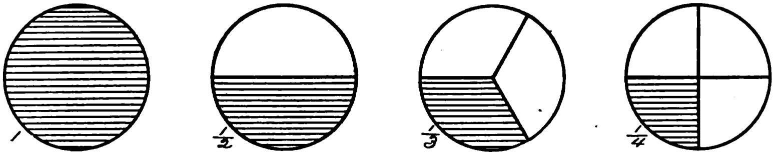
To the Teacher.—The numbers below will afford practice in dividing where there is a remainder. Any of the first 3 lines, or the first 3 numbers in any column, are to be divided by 3, any of the first 4 lines, or 4 numbers in any column by 4, and so on.

	A.	*B.*	*C.*	*D.*	*E.*	*F.*	*G.*	*H.*	*I.*	*J.*
1.	1	7	5	8	2	9	6	3	10	4
2.	16	13	20	12	15	19	11	18	14	17
3.	24	30	25	21	27	28	26	22	29	23
4.	34	39	32	40	35	31	38	36	33	37
5.	45	41	50	46	42	49	47	43	48	44
6.	51	56	52	57	53	58	54	59	55	60
7.	65	70	64	69	63	68	62	67	61	66
8.	74	79	75	80	76	71	78	72	77	73
9.	85	90	84	89	83	88	81	86	82	87
10.	96	91	97	95	92	98	93	99	94	100

45.—Fractions.

ORAL.

1. $\frac{1}{2}$ of 6 books is ⁓; $\frac{1}{3}$ of 12 eggs is ⁓; $\frac{1}{4}$ of 20 cents is ⁓.
2. Separate 24 cherries into 4 equal parts, and there will be ⁓ cherries in each part. $\frac{1}{4}$ of 24 = ⁓.



3. We may separate a *number* into equal parts by division. We may also separate a *single thing* into equal parts. Thus we may cut a circle into 2 equal parts, and call each part $\frac{1}{2}$ of a circle. In 1 there are ⁓ halves.
4. To get $\frac{1}{3}$ of a circle we must divide it into ⁓ equal parts. $\frac{1}{3}+\frac{1}{3}+\frac{1}{3}=1$.
5. A circle may be divided into 4 equal parts, or *fourths* or *quarters*. How many *quarters* in a dollar? How many *quarts* in a gallon?
6. How many *halves* in 1? How many *thirds? Fourths?*
7. $\frac{1}{2}+\frac{1}{2}=$ ⁓; $\frac{1}{3}+\frac{1}{3}=$ ⁓; $\frac{1}{4}+\frac{1}{4}+\frac{1}{4}=$ ⁓; $\frac{3}{4}-\frac{1}{4}=$ ⁓.
8. If I give away $\frac{1}{2}$ of a cake I shall have ⁓ left.
9. If I give away $\frac{1}{3}$ of a cake I shall have ⁓ left.
10. If I give away $\frac{3}{4}$ of a cake I shall have only ⁓ left.

One or more of the equal parts of a thing is a **Fraction.**

11. Show your teacher a fraction. Write the words that represent it. Write the figures that show what it is.
12. Which is larger, $\frac{1}{2}$ of an apple or $\frac{1}{3}$ of an apple? Give your reason.
13. How many halves in $2? **14.** How many thirds in 5 pears?
15. How many dollars in 8 half-dollars? In 12 quarters?
16. Draw a square. Erase $\frac{1}{4}$ of it. What fraction remains?

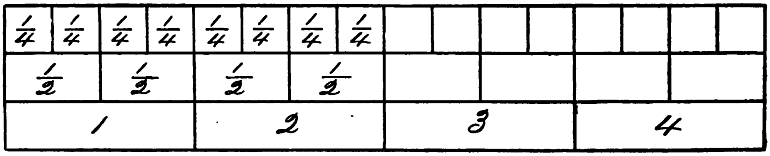
46.—Multiplication and Division by 11.

ORAL.

1. 11 + 11 = 2 × 11, or ⁓. 11 in 22 = ⁓. $\frac{1}{11}$ of 22 is ⁓.
2. 33 = ⁓ × 11. $\frac{1}{3}$ of 33 is ⁓. $\frac{1}{11}$ of 33 is ⁓.
3. 44 apples are ⁓ × 11 apples. 11)44 = ⁓. 4 × ⁓ = 44.
4. 5 × 11 = 55 7 × ⁓ = 77 9 × 11 = 99 11 × 11 = 121
6 × 11 = ⁓ 8 × 11 = ⁓ 10 × 11 = 110 12 × 11 = 132
5. Count by 11's from 0 to 132 and back.
6. 7 × 11 = ⁓. $\frac{1}{11}$ of 88 is ⁓. Nine 11's are ⁓. 11)55.
7. Give the following products: 6 × 11; 8 × 11; 10 × 11; 3 × 11; 9 × 11; 4 × 11; 10 × 11; 12 × 11; 7 × 11; 11 × 11; 2 × 11.
8. Give quotients at sight: $\frac{22}{11}$, $\frac{66}{11}$, $\frac{99}{11}$, $\frac{33}{11}$, $\frac{77}{11}$, $\frac{132}{11}$, $\frac{110}{11}$, $\frac{88}{11}$, $\frac{44}{11}$, $\frac{121}{11}$, $\frac{11}{11}$.
9. When 1 gallon of oil costs 11¢, 5 gallons will cost ⁓ × ⁓, or ⁓ cents.
10. When I pay 77¢ for 7 dozen eggs, one dozen costs me $\frac{1}{7}$ of 77¢, or ⁓ ¢.
11. 11 dimes are ⁓ cents; for 1 dime = ⁓ ¢, and 11 × ⁓ ¢ = ⁓ cents.
12. In the word *subtraction* there are ⁓ letters. If I should write it 11 times, I should make ⁓ letters.
13. If I should buy 11 qt. of peanuts at 6¢ a quart, and sell them for 70 cents, I should gain ⁓ cents. 11 × 6 from 70 leaves ⁓.
14. To get 80 cents I might add ⁓ cents to 7 × 11¢.
15. If I should pay for 11 pounds of cheese at 9¢ a pound with a silver dollar, I should have ⁓ ¢ left.
16. 8 × 11, + 4, + 7, ÷ 11 = ⁓. 132 − 11, ÷ 11, × 11, + 11 = ⁓.
17. 11 pecks = ⁓ quarts. 11 gallons = ⁓ quarts.
18. In 77 days there are ⁓ weeks. 7 in 77 = ⁓.
19. In a year there are 12 months. A boy 11 years old has lived ⁓ × ⁓ months, or ⁓ months.
20. When 6 yards cost 66¢, 1 yard costs ⁓ of ⁓ ¢, or ⁓ ¢; 9 yards will cost ⁓ × ⁓, or ⁓.

47.—Fractions.

ORAL.



1. We measure short distances in *feet* and *inches*.

A foot = 12 inches. 1 ft. =12 in.

2. The picture above shows a measure ∼ inches long. 4 in 12 ∼ times. 4 inches $=\frac{1}{?}$ of a foot.
3. $\frac{1}{2}$ foot = ∼ in. $\frac{1}{4}$ ft. = ∼ in. $\frac{1}{6}$ ft. = ∼ in. $\frac{1}{12}$ ft. = ∼ in.
4. How wide is the cover of this book? How long is it?
5. How long is your slate inside the frame? How wide?
6. Make lines 1 in., 2 in., 3 in., 4 in., 5 in., and 6 in. long.
7. The shortest distances are measured in *parts* of inches. In the picture above each inch is divided into ∼ equal parts called *fourths*, or *quarters*.
8. Each inch is also divided by a vertical line a little longer than the others into ∼ equal parts called *halves*.
9. How many *half*-inches in an inch? How many *fourths* of an inch in an inch?
10. Draw a line $\frac{1}{2}$ in. long. Divide it into 2 equal parts. How long is each part? $\frac{1}{2}$ in. = ∼ fourths.
11. $\frac{1}{2}$ in. + $\frac{1}{4}$ in.= ∼ fourths of an inch. 2 in. = ∼ fourths.
12. In 3 inches there are ∼ fourths. $3\times\frac{4}{4}=\frac{?}{4}$.
13. $1\frac{2}{4}$ inches = how many fourths? $1\frac{1}{2}$ inches = ∼ fourths.
14. 1 inch $+\frac{3}{4}$ inch = ∼ fourths. 2 inches = ∼ quarters.
15. $2\frac{1}{4}$ in. = 9 ∼. $2\frac{1}{2}$ inches = ∼ quarters.
16. How many quarter-inches in 4 inches? In 3 in.?
17. $1\frac{1}{2}$ in. $+\frac{3}{4}$ in. = ∼ quarters. $\frac{9}{4}$ in. = ∼ quarters.
18. $2\frac{1}{4}$ in. $+\frac{1}{2}$ in. = ∼ in. $2\frac{1}{2}$ in. $+1\frac{1}{2}$ in. = ∼ in.

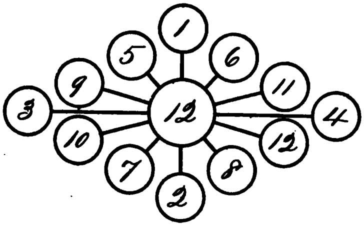
48. — Multiplication and Division by 12.

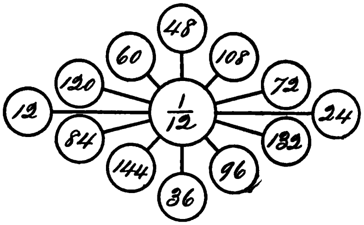
ORAL.

1. Add the 12's in each line, and in each column.
2. Six 12's put together are ⁓.
3. $\frac{1}{12}$ of 60 is ⁓.
4. 84 = ⁓ 12's.
5. $\frac{1}{12}$ of 96 is ⁓.
6. 9 × 12 = ⁓.
7. 12)132.
8. $\frac{48}{12}$ = ⁓.

											12	= 1×12= 12
										12	12	= 2×12= 24
									12	12	12	= 3×12= 36
								12	12	12	12	= 4×12= 48
							12	12	12	12	12	= 5×12= 60
						12	12	12	12	12	12	= 6×12= 72
					12	12	12	12	12	12	12	= 7×12= 84
				12	12	12	12	12	12	12	12	= 8×12= 96
			12	12	12	12	12	12	12	12	12	= 9×12=108
		12	12	12	12	12	12	12	12	12	12	=10×12=120
	12	12	12	12	12	12	12	12	12	12	12	=11×12=132
12	12	12	12	12	12	12	12	12	12	12	12	=12×12=144
12	**24**	**36**	**48**	**60**	**72**	**84**	**96**	**108**	**120**	**132**	**144**	

9. 108 = ⁓ × 12; $\frac{1}{12}$ of 36 is ⁓; ⁓ × ⁓ = 144. $\frac{1}{12}$ of ⁓ is 6.





10. Give products at sight.
11. Give quotients at sight.
12. A foot is 12 inches long; 3 ft. contain ⁓ inches.
13. 7 ft. = ⁓ in.; 9 ft. = ⁓ in.; 4 ft. = ⁓ in.; 60 in. = ⁓ ft.
14. There are 12 months (mo.) in a year (yr.); a girl 9 years old has lived ⁓ × ⁓ mo., or ⁓ mo.
15. In 2 weeks there are ⁓ × 7 days, or ⁓ days.
16. $\frac{1}{12}$ of 72 + $\frac{1}{12}$ of 120 = ⁓. In 132 there are ⁓ 12's.
17. How many dozen in 108? 36? 144? 96? 84? 72?

49.—Multiplication and Division.

WRITTEN.

1. When one book costs $1.38, 7 books will cost 7 × $1.38, or 〰.

$1.38 = Multiplicand.
7 = Multiplier.
$9.66 = Product.

Remember that when there are *cents* in the multiplicand, the last two right-hand figures in the product will be cents, and must be separated from the dollar by a period.

Find the cost of

2. 8 books at $1.24 each.
3. 9 chairs at $2.17 each.
4. 6 rings at $3.46 each.
5. 5 fans at $2.39 each.
6. 7 knives at $1.49 each.
7. 4 pitchers at $3.47 each.
8. 6 vases at $2.96 each.
9. 5 hats at 3.67 each.
10. 9 pins at $2.19 each.
11. 10 pictures at $4.73 each.
12. When I divide $7.50 among 4 boys, each one will receive $\frac{1}{4}$ of $7.50, or 〰.

Divisor = 4)$7.50 = Dividend.
$1.87 = Quotient.
$0.02 = Remainder.
Proof: 4 × $1.87, + $0.02 = $7.50.

Remember that the two right-hand figures are cents when the dividend contains cents. Separate them from the dollars by a period.

Find the cost of *one* when

13. 8 lamps cost $17.28.
14. 9 clocks cost $24.21.
15. 7 desks cost $86.66.
16. 6 spoons cost $11.34.

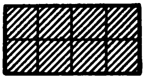
a. Multiply each number below by 2; 3; 4; 5; 6; 7; 8; 9; 10; 11; 12.

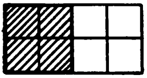
b. Divide each by 2; 3; 4; 5; 6; 7; 8; 9; 10; 11; 12.

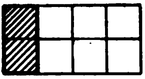
	A.	*B.*	*C.*	*D.*	*E.*
1.	$3.74	$15.63	$68.40	$126.73	$964.25
2.	$4.56	$17.75	$59.17	$137.86	$832.92
3.	$5.78	$16.64	$48.52	$156.45	$761.86
4.	$6.90	$19.79	$97.33	$246.75	$864.47
5.	$7.12	$14.85	$65.24	$258.50	$635.94

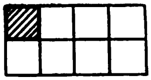
50. — Fractions.

ORAL.









1. Draw an oblong; divide it into halves; mark each half.
2. Draw another oblong; divide it into fourths; mark each fourth.
3. In the same way divide an oblong into eighths. $1=\frac{8}{8}$.
4. Compare $\frac{1}{2}$ of the oblong with $\frac{1}{4}$ of it. Which is larger?
5. How many fourths make one-half? $\frac{?}{4}=\frac{1}{2}$. How many silver quarters make a $\$\frac{1}{2}$?
6. $\$\frac{1}{2}+\$\frac{1}{4}=\sim$ quarters, for $\$\frac{1}{2}=\sim$ quarters, and 1 quarter more will make $\$\frac{3}{4}$.
7. How many 4ths put with $\frac{1}{2}$ will make the whole?
8. In $\frac{1}{2}$ there are $\frac{?}{4}$; $\frac{1}{2}+\frac{1}{4}=\frac{?}{4}$; $\frac{1}{2}-\frac{1}{4}=\frac{?}{4}$.
9. $1-\frac{1}{2}=\sim$. $1-\frac{1}{4}=\sim$. $1-\frac{2}{4}=\sim$. $1-\frac{3}{4}=\sim$.
10. If I spend $\frac{1}{2}$ of my money I shall have $\sim$ left.
11. Fold an oblong paper into halves; into fourths; into eighths. Compare $\frac{1}{4}$ with $\frac{1}{8}$. Which is larger?
12. $\frac{1}{4}=\frac{?}{8}$. Cut an apple into 8 equal parts. How many of the 8 parts will make $\frac{1}{4}$ the apple?
13. $\frac{2}{8}=\frac{1}{?}$. One-half the oblong contains how many eighths? $\frac{1}{2}=\frac{?}{8}$. $\frac{1}{8}+\frac{1}{8}=\sim$. $\frac{1}{8}+\frac{1}{8}+\frac{1}{8}=\sim$.
14. Which is larger, $\$\frac{1}{2}$ or $\$\frac{2}{4}$? $\frac{1}{2}$ an apple or $\frac{4}{8}$ of it?
15. Draw an oblong; divide it into 8ths; erase $\frac{1}{8}$. How many 8ths remain? $1=\frac{?}{8}$; $1-\frac{1}{8}=\frac{?}{8}$; $1=\frac{1}{8}+\frac{?}{8}$.
16. $\frac{1}{4}=$ how many 8ths? Add $\frac{1}{8}$ and $\frac{1}{4}$, and we have $\sim$ 8ths.
17. $\frac{3}{8}+\frac{3}{8}=\frac{?}{8}$. In $\frac{6}{8}$ of the oblong there are $\sim$ 4ths.
18. $\frac{3}{8}$ and how many 8ths more make a whole one?
19. $\frac{2}{8}+\frac{3}{8}=\sim$, $\frac{1}{8}+\frac{2}{8}+\frac{3}{8}=\sim$, $\frac{3}{8}+\frac{3}{8}+\frac{1}{8}=\sim$; $\frac{5}{8}+\frac{2}{8}=\sim$.
20. $\frac{1}{2}=\sim$ 8ths; $\frac{1}{2}+\frac{1}{8}=\frac{?}{8}+\frac{1}{8}=\frac{?}{8}$; $\frac{5}{8}$ taken from $\frac{6}{8}=\sim$.
21. $\frac{5}{8}+\frac{3}{8}=\sim$; $1-\frac{3}{8}=\sim$; $1-\frac{5}{8}=\sim$; $1-\frac{7}{8}=\sim$.
22. In music how many eighth-notes make a quarter-note?

51.—Multiplying by Tens and Ones.

WRITTEN.

1. Ten 4's, or $10 \times 4 = 40$, or 4 tens. $10 \times 8 =$ ∼, or ∼ tens.

A cipher at the right of 4 changes the *ones* to *tens*, or multiplies the number by 10.

2. 10×14
3. 10×15
4. 10×17
5. 10×19
6. 10×21
7. 10×23
8. 10×39
9. 10×48

10. $20 \times 4 = 10 \times 2 \times 4$, or ∼.
11. $20 \times 6 = 10 \times 2 \times 6$, or ∼.
12. $30 \times 8 = 10 \times 3 \times 8$, or ∼.
13. $20 \times 12 = 10 \times 2 \times 12$, or ∼.

14.
$$\begin{array}{rl} 13 & = \text{Multiplicand.} \\ \underline{20} & = \text{Multiplier.} \\ 260 & = \text{Product.} \end{array}$$

15.
$$\begin{array}{r} 14 \\ \underline{20} \\ 280 \end{array}$$

16.
$$\begin{array}{r} 17 \\ \underline{20} \\ 340 \end{array}$$

17. 20×16
18. 20×18
19. 30×21
20. 30×23
21. 40×52
22. 40×63
23. 50×37
24. 50×73

25. Multiply 16 by 14.

Work.

$$\begin{array}{rr} & 16 \\ & \underline{14} \\ \text{4 times } 16 = & 64 \\ \underline{10} \text{ times } 16 = & \underline{160} \\ \text{14 times } 16 = & 224 \end{array}$$

26. What is 24 times 32?

Work.

$$\begin{array}{rl} 32 & = \text{Multiplicand.} \\ \underline{24} & = \text{Multiplier.} \\ 4 \times 32 = 128 & = \text{First partial product.} \\ \underline{20} \times 32 = \underline{640} & = \text{Second partial product.} \\ 24 \times 32 = 768 & = \text{Complete product.} \end{array}$$

Remark.—In practice we omit the cipher in the second partial products.

27. Find 26 times 38.

28. Find 34 times 43.

Multiply	How many are	Find product of	Multiply
29. 34 by 23	**35.** 93×47	**41.** 123 and 67	**47.** $7.68 by 26
30. 47 by 45	**36.** 87×69	**42.** 138 and 89	**48.** $8.59 by 43
31. 58 by 67	**37.** 64×58	**43.** 245 and 95	**49.** $7.32 by 19
32. 63 by 78	**38.** 85×36	**44.** 783 and 47	**50.** $6.45 by 27
33. 75 by 83	**39.** 98×76	**45.** 298 and 64	**51.** $8.73 by 81
34. 82 by 93	**40.** 85×35	**46.** 347 and 93	**52.** $9.47 by 64

53. What will 75 chairs cost if 1 chair costs $1.25?

52. — Making Change.

ORAL.

The coins commonly used in business are of the value of 1¢, 2¢, 5¢, 10¢, 25¢, 50¢, and $1.

Besides coins, bank-notes are also used; they are worth $1, $2, $5, $10, $20, and sometimes more.

1. John buys 17 cents' worth of paper, and gives the dealer a 25-cent piece. He will receive in change — cents.

The dealer may count the change as he gives it to John. Beginning with the cost of the paper, he will say, — 17 and 3 are 20, and 5 are 25, or simply 17, 20, 25, — as he gives him 3 cents and a nickel.

2. Clara buys 38 cents' worth of thread and needles, and gives the clerk a half-dollar. She will receive — cents in change.

The clerk says, — 38 and 2 are 40, and 10 are 50, or 38, 40, 50, — as he gives her 2 cents and a dime.

3. Make change out of a quarter for a 13-cent sale.

4. Count change for a 68-cent sale out of a dollar.

5. If you were a clerk, how would you count change for 51 cents if the buyer gave you $1.00?

6. Mr. Ward sells 7 qt. of milk at 8 cents, and receives 3 silver quarters. Count the change for him.

Make change for —

7. $1.25 out of $5.
8. 73¢ out of $2.
9. 29¢ out of $½.
10. $3 out of $10.
11. $1.56 out of $2.
12. 6 yd. at 11¢ out of $1.

13. Count change out of a dollar bill for a sale of 8 pounds of sugar at 4¢, and 15 cents' worth of soap.

14. How would you change a 2-dollar bill for a friend so that he could pay 29 cents out of it?

15. What coins that you have seen are made of silver?

16. Our government makes *gold* coins called *eagles*, worth $10, and also *half-eagles*, worth $— each. A *double-eagle* is worth $—.

WRITTEN.

1. Find the sum of seventeen dollars and eighty-four cents, and ninety-three dollars and sixty-nine cents.

2. What remains when 2 × 36 is taken from 17 × 36?

3. What shall I pay for 18 tons of coal, when one ton costs $5.75?

4. Frank Curtis has $12.42; he spends ⅑ of it for books. How much *remains?*

5. How many days in a year? There are in

1.	January,	31	5.	May,	31	9.	September,	30
2.	February,	28	6.	June,	30	10.	October,	31
3.	March,	31	7.	July,	31	11.	November,	30
4.	April,	30	8.	August,	31	12.	December,	31

6. Every fourth year is a *leap* year, and then February has 29 days, and the year has ⁓ days.

7. Max is 9 years old; two of the years were leap years. Can you tell how many days he has lived?

8. Add $47½, $69¼, and $27.75.

9. What will 627 2-cent stamps and 500 postal cards cost?

10. How many pounds of flour in 17 barrels, when one barrel contains 196 pounds?

11. How many minutes in 12½ hours?

12 to **19.** Fill the first blank with 2, 3, 4, 6, 8, 9, or 12, and solve the eight examples that you will then have.

When ⁓ books cost $17.28, 1 book will cost ⁓ of $17.28, or ⁓; 29 books will cost ⁓ × ⁓, or ⁓.

20. Make a multiplication table from 1 × 24 = 24 to 12 × 24 = 288.

21. Find the sum of the first 12 multiples of 12.

Find the cost of the following articles: —

22. 3 knives at $1.25 each;
2 spoons at 1.32 each;
2 ladles at 1.50 each.

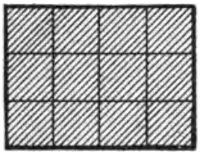
23. 3 pitchers at $2.25 each;
2 bowls at 1.62 each;
6 pails at 1.00 each.

54.—Buying and Selling.

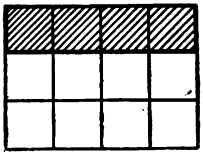
ORAL.

1. What is a merchant?
2. A merchant buys flour at $5 a barrel and sells it for $5.25. He gains ⁓ on each barrel.
3. To gain one dollar he would have to sell ⁓ barrels.
4. If Henry buys bananas for 15 cents a dozen and sells them at 2 cents each, how much does he make on every dozen? $12 \times 2 - 15 =$ ⁓.
5. A dealer bought coal at $4.75 a ton, and sold it for $5.50. What did he gain on a ton?
6. If you should buy a knife for 37¢ and sell it for a half-dollar, what would you gain?
7. Charles's father bought him a bicycle for $37. After 6 months it was sold for $34.50. What was lost?
8. A pedler bought a bunch of 108 bananas for $1 and sold them at 20 cents a dozen. How much did he gain?
9. When a grocer buys pepper for 11 cents a pound and sells it for 16 cents a pound, he makes ⁓ cents on every pound, or ⁓ cents on 10 pounds.
10. If I gain 10 cents on every book I sell, to gain 80 cents I must sell ⁓ books. $80 \div 10 =$ ⁓.
11. I bought a fishing-rod for $1 and sold it for 75¢. I lost ⁓.
12. A farmer bought a horse for $100. He traded his horse for a yoke of oxen, and sold the oxen for $120. He gained ⁓ dollars.
13. A provision dealer buys meat at wholesale for 12 cents a pound and retails it at 16 cents. How much does he gain on 12 pounds?
14. A grocer sold pickles for 30 cents a jar and made 8 cents. A jar must have cost him ⁓ cents.
15. How do storekeepers earn their living?
16. If cloth costs 16 cents a yard, and is sold for 20 cents a yard, what will be gained in selling 12 yards?

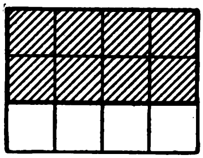
55.—Finding Parts of Numbers.



12 squares.



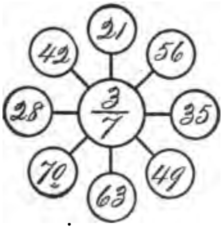
$\frac{1}{3}$ of 12 squares.



$\frac{2}{3}$ of 12 squares.

	1.	2.	3.	4.	5.	6.
7.	$\frac{1}{4}$ of 32	$\frac{1}{7}$ of 28	$\frac{1}{8}$ of 16	$\frac{1}{6}$ of 12	$\frac{1}{9}$ of 45	$\frac{1}{7}$ of 35
8.	$\frac{1}{8}$ of 72	$\frac{1}{6}$ of 54	$\frac{1}{6}$ of 18	$\frac{1}{8}$ of 32	$\frac{1}{4}$ of 16	$\frac{1}{9}$ of 63
9.	$\frac{1}{7}$ of 21	$\frac{1}{5}$ of 20	$\frac{1}{8}$ of 56	$\frac{1}{3}$ of 21	$\frac{1}{5}$ of 35	$\frac{1}{6}$ of 30
10.	$\frac{1}{5}$ of 40	$\frac{1}{9}$ of 81	$\frac{1}{9}$ of 72	$\frac{1}{9}$ of 36	$\frac{1}{7}$ of 56	$\frac{1}{5}$ of 45

11.



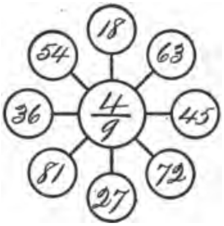
12.

$\frac{1}{4}$ of 28
$\frac{1}{6}$ of 24
$\frac{1}{6}$ of 42
$\frac{1}{8}$ of 40
$\frac{1}{7}$ of 42
$\frac{1}{4}$ of 20

13.

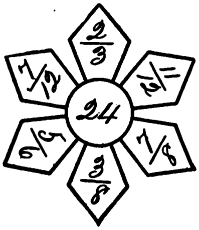
$\frac{1}{6}$ of 48
$\frac{1}{8}$ of 64
$\frac{1}{7}$ of 63
$\frac{1}{9}$ of 27
$\frac{1}{5}$ of 30
$\frac{1}{4}$ of 36

14.



	15.	16.	17.	18.	19.	20.
21.	$\frac{1}{3}$ of 27	$\frac{1}{3}$ of 24	$\frac{1}{8}$ of 24	$\frac{1}{2}$ of 14	$\frac{1}{12}$ of 60	$\frac{1}{12}$ of 72
22.	$\frac{1}{9}$ of 18	$\frac{1}{7}$ of 49	$\frac{1}{12}$ of 36	$\frac{1}{10}$ of 50	$\frac{8}{12}$ of 60	$\frac{7}{12}$ of 72
23.	$\frac{1}{5}$ of 25	$\frac{2}{7}$ of 49	$\frac{5}{12}$ of 36	$\frac{3}{10}$ of 50	$\frac{1}{11}$ of 77	$\frac{1}{12}$ of 108
24.	$\frac{2}{5}$ of 25	$\frac{1}{3}$ of 18	$\frac{1}{4}$ of 24	$\frac{7}{10}$ of 100	$\frac{2}{11}$ of 77	$\frac{11}{12}$ of 108

25.



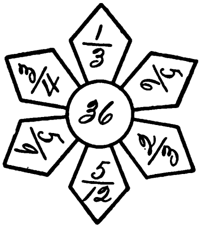
26.

$\frac{1}{8}$ of 48
$\frac{1}{12}$ of 144
$\frac{1}{12}$ of 48
$\frac{3}{8}$ of 48
$\frac{1}{6}$ of 36
$\frac{5}{12}$ of 48

27.

$\frac{1}{9}$ of 54
$\frac{1}{12}$ of 96
$\frac{1}{12}$ of 132
$\frac{1}{11}$ of 66
$\frac{7}{12}$ of 96
$\frac{10}{12}$ of 132

28.



56.—Review.

ORAL.

1. Six, 8, and 7 are the parts of what number?
2. Gladys had $3.75 in her bank, but took out a half-dollar. How much had she left?
3. Howard has 12 nickels in his bag. How much more than fifty cents would you give him for them?
4. Edward exchanges 200 pennies for half-dollars. How many does he get?
5. $\frac{1}{12}$ of 84¢ is 〰.
6. $9 is $\frac{1}{9}$ of 〰.
7. 12¢ is $\frac{1}{9}$ of 〰.
8. 3$\frac{1}{4}$ gal. are 〰 qt.
9. $\frac{1}{2}$ a day is 〰 hour.
10. $\frac{3}{4}$ in. + $\frac{1}{2}$ in. = 〰 in.
11. $\frac{3}{8}$ of 24 min. = 〰 min.
12. $\frac{1}{8}+\frac{1}{4}+\frac{1}{2}=\frac{?}{8}$.
13. 1 yd. and 6 in. = 〰 in.
14. A bushel bag holds 〰 qt.
15. How many badges 3 inches long will a yard of blue ribbon make?
16. Sarah Field bought a book for 20¢, a slate for 15¢, a pencil for 3¢, and a 1¢-sponge. She gave the clerk a dollar. Count the change.
17. What should you pay for 6 postal cards and 12 2-cent stamps?
18. It costs $\frac{1}{2}$ cent an ounce to send a book by mail. How many 2-cent stamps will pay the postage on a book weighing 12 ounces?
19. Begin at 100 and count backward by 7's.
20. How many hours are you in school every day? Prove it.
21. How many weeks in a month of 30 days?
22. When 1 pound costs 12 cents, what will 5 pounds cost?
23. When 6 quarts cost 42 cents, what will 1 quart cost?
24. When 5 yards cost 60 cents, what will 7 yards cost?
25. How many lines must you make in drawing 8 triangles and 6 squares?
26. Draw two oblongs, and show that $\frac{1}{5}$ is the same as $\frac{2}{10}$.
27. Mention a number that may be divided by 4, 6, and 9.

57.—Review.

WRITTEN.

1. A steamer has on board 296 oxen, 649 sheep, 214 horses, and 492 swine. How many animals does she carry?
2. Out of an oil-tank containing 4361 gallons, 794 gallons are taken. How many gallons remain?
3. A nursery-man sets out 34 rows of plants with 49 in a row. How many plants does he set out?
4. A pencil-maker puts 1728 pencils into bundles of a dozen each. How many bundles are there?
5. How many inches long is a piece of ribbon that measures 8 yards?
6. In a year there are 365 days. How much more than 52 weeks is this?
7. Edward Howes paid $1.87 for his sled, and sold it for $2.41. What did he gain?
8. If you earn 3 cents a day, how much can you earn in 8 weeks?
9. At 5 cents each, how many children can be carried to the Park for $8.75?
10. A fisherman caught 968 fish; $\frac{1}{8}$ were haddock and the rest were cod. How many were cod?
11. Henry earns 67 cents a day picking cranberries. How much can he earn in 3 weeks?
12. At 20 cents a can, what will 18 cans of soup cost?
13. A merchant receives $3.47, $1.29, $6.82, and $5.95, and then pays out $4.26. What has he left?
14. A quire of paper contains 24 sheets. How many sheets in 17 quires?
15. What is left of $5.00 after paying for $6\frac{1}{2}$ lb. of tea at 50 cents a pound?
16. Charles and his father ride to the city and back. The fare each way is 16 cents. Charles rides for a half fare. What do they spend for fares?

58.—Weights and Measures in Review.

1. Some articles of merchandise are sold by *measure*, some by *count*, and some by *weight*.

   Vinegar, oil, and 〰 are sold by the 〰 or 〰. Potatoes and 〰 are sold by the 〰 or 〰. Eggs, lemons, and 〰 are sold by the 〰. Butter, cheese, and 〰 are sold by the 〰, and coal and hay by the 〰. Cloth and 〰 are sold by the 〰. Time is measured in 〰.

2. 〰 pt. = 1 qt.
   〰 qt. = 1 gal.
3. 8 〰 = 1 pk.
   〰 pk. = 1 bu.
4. 〰 in. = 1 ft.
   〰 ft. = 1 yd.

16 ounces (oz.) are **1 pound** (lb.).
2000 lbs. are **1 ton** (T.).

5. 3 quarts = 〰 pints; 2 gal. = 〰 qt.; $2\frac{1}{2}$ gal. = 〰 qt.
6. At 2¢ each, a dozen eggs will cost 〰 ¢. $12 \times 2 =$ 〰.
7. At 20¢ a doz., $\frac{1}{2}$ doz. lemons will cost 〰 ¢. $\frac{1}{2}$ of 20 is 〰.
8. $\frac{1}{2}$ doz. + $\frac{1}{3}$ doz. + $\frac{1}{4}$ doz. = 〰. $2\frac{1}{2}$ doz. = 〰.
9. While carrying 5 doz. eggs to market a farmer broke 8. He had 〰 left. $5 \times 12, -8 =$ 〰.
10. In 1 foot there are 〰 inches; in 〰 feet, or 1 yard, there are 〰 × 〰 inches, or 〰. A yard stick is 〰 inches long.
11. $\frac{1}{2}$ a yard stick is 〰 inches long. $\frac{1}{3}$ of 36 in. = 〰 in.
12. When 1 yard of ribbon costs 16 cents, $1\frac{1}{4}$ yards will cost 〰 cents. $1 \times 16, + \frac{1}{4}$ of 16 = 〰.
13. 1 lb. = 16 oz.; $\frac{1}{2}$ lb. = 〰 oz.; $\frac{1}{4}$ lb. = 〰 oz.; $\frac{3}{4}$ lb. = 〰 oz.
14. 8 oz. = 〰 lb.; 4 oz. = 〰 lb.; 12 oz. = 〰 lb.
15. 1 pound and 10 ounces = 〰 ounces. 26 = 〰 + 10.
16. At 20 cents a pound, $1\frac{1}{2}$ lb. of butter cost 〰 cents.
17. $\frac{1}{4}$ lb. of cheese will cost 〰 ¢ at 12¢ a pound. $\frac{1}{4}$ of 12 is 〰.
18. An hour = 〰 minutes; $\frac{1}{2}$ hour = 〰 min.; $\frac{1}{4}$ h. = 〰 min.
19. From 9 o'clock to 12 o'clock is 〰 hours. From 10 o'clock to 1 o'clock is 〰 hours.
20. From Tuesday noon to Wednesday noon is just 〰 hours.

1. Write 4 thousands 6 hundreds 8 tens 5 ones.
2. Write 4 thousands 9 tens 4 ones.
3. Write 6 tens 5 thousands 7 ones 8 hundreds.
4. Tell what each figure represents in these numbers: —

6894, 3829, 4037, 5040, 6009, 8392.

In a whole number the *fifth* figure from the right stands for **ten-thousands,** and the sixth for **hundred-thousands.** Thus: —

20,000 = 2 *ten-thousands*, or twenty *thousand;*
200,000 = 2 *hundred-thousands*, or two hundred *thousand;*
648,000 = 6 *hundred-thousands*, 4 *ten-thousands*, 8 *thousands*, or 648 *thousand.*

The three right-hand figures make the *ones' group*, and the other figures make the *thousands' group*. If we separate these groups by a comma, it will make the reading easier. Do not use *and* in reading a whole number.

5. Read the population of the following cities in 1890: —

Albany,	94,923	Denver,	106,713	San Francisco,	298,997
Atlanta,	65,523	Louisville,	161,129	Boston,	448,447
St. Paul,	133,156	New Orleans,	242,039	St. Louis,	451,770
Cambridge,	70,028	Cincinnati,	296,908	Brooklyn,	806,343

Reading numbers written in figures is **Numeration.**

6. In a bank were the following sums of money; write them in figures: —

In gold: sixty-two *thousand* three hundred forty-eight dollars. In silver: one hundred seven *thousand* twenty-nine dollars. In bank-notes: eight hundred sixty-three *thousand* eight dollars.

Writing numbers in figures is **Notation.**

60.—Notation and Numeration.

1. Show the numbers 5 and 10. Write them in words; in figures, and in Roman numerals.
2. What is the difference between a figure and a number?
3. Do you think you ever saw a thousand things of the same kind at one time?
4. How many people live in your city or town?
5. Do we often need to use large numbers? When?

In a whole number the 7th, 8th, and 9th figures make the **millions'** group, containing millions, ten-millions, and hundred-millions. Thus:—

1,000,000 = 1 *million;* **20**,000,000 = 20 *millions;*

132,460,910 = 132 *millions*, 460 thousands, 960 (ones).

The names of the first three groups, and the names and order of units, are shown in the following

TABLE.

NAMES OF GROUPS.	Millions.			Thousands.			Ones.		
NAMES OF UNITS.	Hundred-*millions.*	Ten-*millions.*	*Millions.*	Hundred-*thousands.*	Ten-*thousands.*	*Thousands.*	Hundred *ones.*	Ten *ones.*	*Ones.*
FIGURES	1	3	9,	6	2	4,	8	5	7

The number in the table is one hundred thirty-nine *million*, six hundred twenty-four *thousand*, eight hundred fifty-seven (ones).

We do not use the group-name, *ones*, in reading a number.

6. How many figures are there in each *full* group?
7. Copy the above table, and write below the number in it any other numbers your teacher may dictate.
8. Read the numbers you have written.

61.—Notation and Numeration.

1. Read the population of the following in 1890:—

New York City,	1,515,301	Philadelphia,	1,046,964
New York State,	5,997,853	Pennsylvania,	5,258,014
Chicago,	1,099,850	California,	1,208,130
Illinois,	3,826,351	United States,	62,622,250

2. Fill the blanks in the following:—

10 ones = 1 ten
10 ∼ = 1 hundred
∼ hundreds = 1 ∼

10 thousands = ∼ ten-thousand
10 ∼ = 1 hundred-thousand
10 ∼ = 1 million

Principle.—**Ten** *units of any order make* **one** *of the next left-hand order.*

This is the reason that our system of numbers is called a *decimal* system. *Decimal* comes from a word meaning *ten.*

3. Review page 20. What seven letters are sometimes used to stand for numbers?
4. What is the value of each?
5. Try to find why this method of writing numbers is called the Roman method.
6. Learn for what the following letters stand:—

C.	=100;	CX.	=110	D.	= 500;	DXIV.	= 514
CC.	=200;	CCL.	=250	DC.	= 600;	DCLX.	= 660
CCC.	=300;	CCCV.	=305	M.	=1000;	MM.	=2000
CD.	=400;	CDXX.	=420	MD.	=1500;	MDCV.	=1605

Read the following to show the meaning:—

7. Vol. XIII., Chap. XCIX.
8. Psalm CXXXIX., verse 7.
9. This church was built in MDII.
10. Henry VIII.; Pope Leo XIII.
11. Write the number of the present year in Roman notation.

62.—Combining Numbers.

ORAL.

1. What sum should you obtain by putting together 8 cents, 4 cents, 7 cents, and 6 cents? Did you find this result by adding or multiplying?

We put *unequal* numbers of the same kind together into one larger number, called the sum or amount, by **Addition.**

2. How much money will a purse contain if you put 10 5-cent pieces into it? Did you add or multiply to get your result? How may you prove that you are right?

We generally put *equal* numbers of the same kind together into one number or *product* by **Multiplication.** We may do this by addition, but the process is much longer.

3. $6+$7+$8+$9= what?
4. $8+$8+$8+$8+$8+$8+$8= what?

Tell the sum of

cents. cents.
5. 12+13
6. 14+15
7. 15+16
8. 17+16
9. 17+19

cents. cents.
10. 20+28
11. 23+25
12. 32+16
13. 28+12
14. 37+19

Give the product of

15. 2×$20
16. 3×$30
17. 4×$50
18. 5×$40
19. 6×$30

20. 7×$20
21. 8×$60
22. 9×$50
23. 4×$80
24. 3×$70

25. I bought a book for 12 cents and sold it for twice as much. I received — cents for it, and gained —.

Find what I pay for

26. 3 gal. oil at 10¢
1 bunch wicks 6¢
27. 4 lb. sugar at 5¢
2 lb. rice at 5¢
28. 2 qt. milk at 4¢
1 pt. cream at 10¢

Find the cost of

29. 1 pair gloves 20¢
1 yd. ribbon 19¢
30. 1 can soup 30¢
1 jar pickles 25¢
31. 1½ doz. eggs at 20¢
1 lb. butter 30¢

63.—Separating a Number into Parts.

ORAL.

1. Out of a purse containing $25 I took $5. How much remained? How was the result found?
2. How many 5-dollar bills can you take out of $25? Did you find your answer by subtraction or division?
3. If you fill a 6-quart can from a 20-quart tank, how many quarts will remain?

Taking part of a number out of it to find the remainder is **Subtraction.**

4. If I divide 108 lead-pencils into 9 bundles, how many will there be in a bundle?

Separating a number into equal parts is **Division.**

5. Mary is 9 years old, and her brother is 15 years old. What is the difference in their ages?
6. How do we find the difference between two numbers?

What is left when you	What is one
7. Take 17¢ out of $$\frac{1}{4}$?	11. Of the 7 equal parts of $49?
8. Spend 15¢ out of $$\frac{1}{2}$?	12. Of the 6 equal parts of 72¢?
9. Give away 12¢ from $1?	13. Of the 9 equal parts of 81 ft.?
10. Lose 4 of 2 doz. pins?	14. Of the 8 equal parts of 48 in.?

15. I spent 20 cents for ribbon and 40 cents for cloth. What had I left out of a dollar?
16. I paid 35 cents for 7 pounds of sugar. What was that a pound? 8 pounds would have cost ⁓.
17. $\frac{1}{12}$ of a yard = ⁓ inches.
18. $\frac{1}{9}$ of 63 days = 1 ⁓.
19. $\frac{1}{9}$ of 90¢ = 1 ⁓.
20. $\frac{1}{8}$ of 32 qts. = 1 ⁓.
21. At 28¢ a pound $\frac{1}{4}$ lb. of butter will cost ⁓ cents.
22. Count backward by 7's from 60; by 8's.
23. 18 + ⁓ = 25.
24. ⁓ + 19 = 27.
25. $\frac{2}{3}$ of 12 is ⁓.
26. $\frac{3}{4}$ of 1 doz. is ⁓.
27. 13 = 24 − ⁓.
28. 18 = 27 − ⁓.
29. Separate 20 into 3 unequal parts; into 5 equal parts.

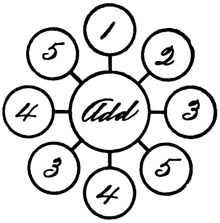
64.—Practice in Addition.

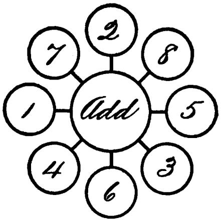
.ORAL.

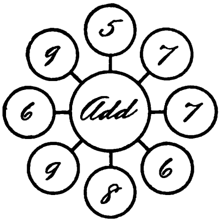
	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x
1.	2	8	3	3	9	6	4	1	7	5	2	8	6	3	9	7	4	1	5	7	8	6	9	7
2.	4	7	8	5	3	9	6	4	5	3	2	8	3	7	6	5	9	4	3	8	2	1	7	6
3.	8	4	9	6	7	3	8	9	5	4	6	7	3	9	7	8	6	5	4	2	9	3	7	8
4.	6	3	9	7	5	4	9	5	8	2	6	4	3	9	6	5	7	1	4	9	2	8	3	6
5.	3	4	8	7	3	6	7	4	9	8	3	2	4	5	9	8	4	3	7	6	8	9	9	8
6.	7	7	6	7	4	8	8	9	8	9	7	6	4	9	3	1	4	8	9	7	7	6	6	4
7.	2	4	5	9	8	5	4	7	2	3	6	4	5	5	8	7	6	9	3	8	6	4	9	1
8.	8	9	7	5	4	8	4	3	3	6	2	3	7	9	8	4	2	6	5	4	3	7	3	8

To the Teacher. **This table is so arranged as to give the pupil practice in giving at sight the sum of 3, 4, 5, 6, or more numbers. He should be taught in all his adding to combine instantly the two or more numbers in any line or column that make ten. Thus, in column a he should see that 8 + 2, 7 + 3, 6 + 4, 8 + 2 are each equal to 10, and announce the sum of the 4 tens, 40, at once.**

a. Begin at any number and add in either direction till you reach 100.







b. To each of the numbers below add 2; 3; 4; 5; 6; 7; 8; 9. Follow either columns or lines.

	M.	*N.*	*O.*	*P.*	*Q.*	*R.*	*S.*	*T.*	*U.*	*V.*	*W.*	*X.*	*Y.*
1.	22	56	87	42	84	72	39	23	85	67	25	69	79
2.	94	62	47	24	55	32	63	89	34	78	49	96	52
3.	38	33	93	82	74	64	45	75	57	29	95	66	97
4.	83	73	27	65	37	99	77	26	98	86	36	35	68
5.	48	28	92	46	43	59	54	47	44	76	58	88	53

65.—Practice in Written Addition.

	K.	*L.*	*M.*	*N.*	*O.*	
a.	$24.75	$63.78	$129.82	$637.91	$946.87	**a.**
b.	15.45	26.56	376.71	487.82	598.93	**b.**
c.	69.99	71.91	828.24	937.35	146.46	**c.**
d.	24.14	35.25	463.67	574.78	685.89	**d.**
e.	78.18	89.29	913.14	124.26	235.37	**e.**
f.	33.63	44.74	558.56	669.65	771.78	**f.**
g.	87.27	98.38	194.91	215.12	326.23	**g.**
h.	42.71	53.82	649.34	751.45	862.56	**h.**
i.	96.36	17.47	285.87	396.98	417.19	**i.**
j.	51.82	62.93	731.49	842.58	953.67	**j.**

Exercises.

1–10. Find the sum of the numbers in each line.
11–15. Add the first *five* numbers in each column.
16–20. What is the sum of *fghij* in each column?
21–25. Add the first *six* numbers in each column.
26–30. Add the last *six* numbers in each column.
31–35. Add the first *seven* numbers in each column.
36–40. Add each column, omitting *f* and *d*.
41–45. Find the amount of each column, omitting *a*.
46–50. What is the sum of each column without *j*?
51–55. Find the footing of each column.
56. Find the sum of all the numbers in lines *a* and *b*.
57. What is the amount of numbers in lines *b* and *c*?
58. Add the numbers in lines *c* and *d*.
59. Put the numbers in lines *d* and *e* into one sum.
60. Find the amount of numbers in lines *e* and *f*.
61. What is the sum of the ten numbers in lines *f* and *g*?
62. Put the ten numbers in line *g* and *h* into one sum.
63. Add the numbers in lines *h* and *i*.
64. Find the amount of the numbers in the last two lines.

66.—Addition.

ORAL.

1. Of what number are 17, 5, and 19 the parts?
2. Ella walks west 27 feet, and Jane walks east 32 feet. How far apart are they?
3. $40+30+90=?$
4. $\$7.50+\$2.25=?$
5. $50+60+90+80+100=?$
6. $\$0.75+\$0.25+\$2.35=?$
7. $2\frac{1}{2}$ ft. added to $3\frac{1}{2}$ ft. are what?
8. I paid $0.18 for nails, $0.38 for a hammer, and $.12 for screws. Count the change back from a dollar.
9. What is the weight of a mixture of 18 lb. of almonds, 22 lb. of walnuts, 5 lb. of pecans, and 7 lb. of filberts?
10. What is the distance around a slate 12 inches long and 10 inches wide?
11. A post in the middle of a field is 13 rods from the fence. How wide is the field?
12. How many feet of fence will be needed to surround a lot 100 feet long and 50 feet wide?
13. $300+500+700=?$
14. $\$800+\$900+\$300=?$

What did I pay in all for the following articles?

15.	Mustard,	12¢	**16.**	Raisins,	$0.17	**17.**	Broom,	$0.30
	Cloves,	9¢		Prunes,	0.18		Brush,	0.50
	Mace,	10¢		Currants,	0.12		Dustpan,	0.25

18. What three silver coins make $1? What seven?
19. Mary draws the twins in a carriage weighing 32 pounds. Eddie weighs 16 pounds, and Maud weighs 12 pounds. How heavy is Mary's load?

Find the cost of the following articles:—

20.	Scissors,	$0.25	**21.**	Paper,	17¢	**22.**	Shoes,	$2.00
	Basket,	0.50		Envelopes,	12¢		Gloves,	0.75
	Needles,	0.10		Penholder,	5¢		Hat,	1.25
	Thimble,	0.25		Stamps,	8¢		Necktie,	0.50

67.—Addition.

WRITTEN.

What was the population in 1890 of the following cities of Massachusetts?

		Ward 1.	Ward 2.	Ward 3.	Ward 4.	Ward 5.	Ward 6.
1.	Lowell,	11398	13189	14298	12860	15967	9984
2.	Quincy,	3269	2383	3741	4164	1812	1354
3.	Fitchburg,	4058	5238	3195	2252	3316	3978
4.	Lawrence,	6952	6338	8368	9147	7888	5961
5.	New Bedford,	10942	4577	4613	3522	5283	11796

6. James has $2.17, Edward has $1.25 more than James, and Charles has $2.74 more than Edward. How much money have the three boys?

7. What is the distance around your schoolroom if it is 32 ft. long and 28 ft. wide?

8. Mr. Jackson paid $457.25 for a horse, $287.62 for a carryall, $56.85 for a harness, $12.75 for robes, and $2.62 for a whip. What did the outfit cost?

Below are a dealer's sales for a week. Find his sales for each day, and also the value of each kind of merchandise sold.

		9.	10.	11.	12.	13.	14.
		Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.
15.	Coal,	$37.94	$246.93	$89.75	$841.96	$63.29	$63.92
16.	Wood,	39.75	81.92	91.32	372.94	87.58	74.85
17.	Cement,	24.62	101.75	3.75	86.91	14.62	59.81
18.	Lime,	19.83	93.65	69.48	18.42	93.87	6.43
19.	Hair,	17.69	29.32	27.85	9.75	49.24	2.84

20. My parlor is 18 ft. long and 14 ft. wide. My sitting-room is 15 ft. long and $12\frac{1}{2}$ ft. wide. How much picture-moulding shall I need, allowing 4 ft. for waste?

21. Add all the numbers between 3748 and 3800 that end in 9.

68. — Subtraction.

ORAL.

Give differences as rapidly as possible at sight : —

1.	67	59	75	86	94	47	85	53	78	59	135	265	318	209
	30	40	60	50	71	32	53	23	36	48	80	95	78	90

2.	539	827	396	417	824	391	864	249	618	347	892	346
	408	325	190	95	704	270	453	127	93	86	95	150

3.	1246	3721	4986	5478	3966	2791	4865	7983	8472
	300	600	880	5406	3900	2500	4105	6981	460

4. Subtract by 6's from 81 to 3; from 56 to 2.

Subtract each one of the following numbers from 100, giving the remainder only : —

	5.	**6.**	**7.**	**8.**	**9.**	**10.**	**11.**	**12.**	**13.**	**14.**	**15.**	**16.**	**17.**	**18.**
19.	11	88	44	74	52	70	36	13	60	75	37	48	31	87
20.	35	61	82	14	91	33	22	65	42	53	15	59	69	47
21.	83	30	23	57	89	43	95	29	90	32	84	26	37	16
22.	20	81	73	63	21	94	56	99	17	93	41	66	58	51
23.	92	19	63	45	96	18	50	46	76	49	71	62	27	85
24.	64	75	24	90	34	39	78	38	80	25	97	54	98	40

25. Call each of the preceding numbers so many *cents*, and "count back the change" between it and a dollar.

For Dictation.

1. 16 + 3, − 9
2. 42 − 30
3. 64 − 8
4. 82 − 20
5. 27 + 6, − 4
6. 50 − 16
7. 25 − 7 − 8
8. 60 − 12
9. 14 from 40
10. 12 from 82

1. 25 from 100
2. 100 − 65
3. 45 from 100
4. 80 from 100
5. 12 from 50
6. 100 − 60
7. 100 − 88
8. 54 from 100
9. 300 from 1000
10. 1000 − 250

1. $1.00 less 2 dimes
2. $1.00 less 3 nickels
3. $½ less 3 dimes
4. $0.35 out of $1.00
5. $1.25 out of $2.00
6. $0.62 out of $0.75
7. $0.12 out of $½
8. $1.50 out of $5.00
9. $5.00 less $2.75
10. $10.00 less $4.25

69. — Practice in Subtraction.

WRITTEN.

1. Take 372 out of 700.

Work.

$$\begin{array}{r} 700=600+90+10\\ \underline{372}=\underline{300+70+\ \ 2}\\ 328=300+20+\ \ 8\end{array}$$

Explanation. As there are no ones and no tens in the minuend, we change 1 of the 7 hundreds to 10 tens; we then change 1 of these 10 tens to 10 ones. The minuend then becomes

6 *hundreds* 9 *tens* 10 *ones*
from which we take 3 *hundreds* 7 *tens* 2 *ones*
and we have as the remainder 3 hundreds 2 tens 8 ones, or 328.

In practice we may simply say 2 from 10, 8; 7 from 9, 2; 3 from 6, 3. Remainder 328.

2. 610 − 425. **3.** 500 − 137. **4.** 8120 − 3769. **5.** 9000 − 137.

To the Teacher. In the following exercises the pupil is to find the difference between numbers in the same line in two columns. Each direction furnishes 10 exercises. Thus Ex. 1 is $219.87 − $83.95; Ex. 2 is $641.53 − $29.34, and so on.

No. of Exercises.	Find the difference between the numbers in columns
1–10.	**a** and **b.**
11–20.	**b** and **c.**
21–30.	**c** and **d.**
31–40.	**d** and **e.**
41–50.	**e** and **f.**
51–60.	**a** and **c.**
61–70.	**b** and **d.**
71–80.	**c** and **e.**
81–90.	**d** and **f.**

	a.	b.	c.	d.	e.	f.
1.	$83.95	$219.87	$1000.	$3491.	$ 847.95	$347.62
2.	29.34	641.53	349.00	6328.	2396.	297.88
3.	62.49	827.31	82.37	493.75	473.27	399.79
4.	37.84	468.32	69.42	860.00	234.58	683.94
5.	29.36	921.38	118.75	397.00	583.20	725.91
6.	48.75	316.29	467.63	27.18	600.27	6000.
7.	94.89	47.96	339.32	95.22	555.75	849.32
8.	67.66	37.94	5000.	68.31	638.72	683.70
9.	39.84	182.13	64.00	159.39	911.87	45.11
10.	98.78	76.95	85.37	683.97	647.39	837.21

70.—Subtraction.

ORAL.

1. Mary had $0.18 and earned $0.12 more. She then spent a dime and lost a nickel. What had she left?

2. 50=16+?

3. 27+?=50

4. ?+32=50

5. 50−18=?

6. 50−?=29

7. ?−36=14

8. 100=52+?

9. 37+?=100

10. ?+73=100

11. 100−64=?

12. 100−?=47

13. ?−61=59

14. Out of a class containing 25 girls and 15 boys, the teacher dismisses 12 scholars. How many remain?

15. Mr. Brown receives $60. He pays $15 for rent and $15 for coal. How much has he left?

16. After 16 quarts are put into a bushel basket, how many more quarts are needed to fill it?

17. One 4th of July Edward Bright received $1.20 for lemonade which he sold. His lemons cost him 40¢, his sugar 15¢, and he paid 10¢ for ice. How much did he gain?

18. 37−9−8−5=?

19. Take 13 from 69−8.

20. Take 30−7 from 32+9.

21. Take $1.25 from $2.50.

22. Draw a square 5 inches long, and another square 2 inches long. How much farther is it around the first than around the second?

23. Three girls have together 35 cents; the first has 13 cents, and the second has as much as the third. How many has she?

24. If you start to do an errand at a quarter of 8, and are gone 25 minutes, at what time do you return?

25. Count back the change to a gentleman who buys 37 cents' worth and gives you a dollar.

26. Count back the change to a lady who purchases $1.72 worth and gives you a $5-bill.

27. Clara has $0.75, Grace has $0.50, Sarah has $¼, and I have $½. How much shall I have if each girl gives me all her money but 25 cents?

71.—Exercises in Subtraction.

WRITTEN.

1. My coal cost me $57.75. I pay $4.37 for putting it in the cellar. Last year I paid $49.25 for my winter's coal, and $2.75 for housing it. How much more do I pay this year than I paid last year?

You will find below what three boys receive and what each spends. How much has each left?

2. Henry.		3. Robert.		4. Thomas.	
Received.	Paid.	Received.	Paid.	Received.	Paid.
$3.78	$0.98	$8.94	$4.11	$6.41	$6.43
1.29	1.46	6.29	6.98	2.45	2.98
4.63	2.79	3.82	4.59	0.79	0.87

5. I owe a grocer $80.00. If I begin Monday and pay him $3.78 every day during the week, how much shall I owe him Saturday evening?
6. How much shall I add to $47.83 to make it $78.34?
7. Subtract from 100 by 7's until your remainder is 51. What is the sum of your remainders?
8. I have bought 12,846 lb. of coal. It comes in 3 loads. The first weighs 4785 lb., and the second 5640 lb. What ought the third to weigh?

9. $84.69=$24.38+?
10. $39.54+?=$90
11. $200−?=$95.42
12. $649−$8.42−$19?
13. 38−17½
14. 263−23½

15. If it requires 375,000 bricks to build a house, and 182,575 have been received, how many more must be bought?
16. A doctor owes a grocer $287.83, and the grocer owes the doctor $175.28. The doctor pays $28.36. How much does he still owe?
17. The subtrahend = $286.42; the remainder = $179.39. What is the minuend?

72.—Abstract and Concrete Numbers.

1. What is the difference between figures and numbers?

2. Which of the following numbers can be seen, handled, weighed, or measured, or, in other words, are *concrete?* 5 books; 3 ft.; $9; 15; 6 gal.; 23; 10 lb.; 14; 7 strokes.

3. Which of these numbers are invisible and exist only in the mind, or are *abstract?*

Numbers that may be recognized by one of the senses are called **concrete** numbers.

Invisible numbers that exist only in the mind are called **abstract** numbers.

4. In what respect are 9 ft. and 11 ft. alike? Can you think of any respect in which 5 gallons and 8 hours are alike?

Like numbers have units of the same name and size.

5. Mention three like numbers; four that are unlike. Why are all abstract numbers like numbers?

6. Using the objects, actually multiply 2 pencils or 2 books by 3. Which of these numbers do you see and handle? Which is abstract? Of what use is the abstract number?

7. What are the two factors of 15 cents? Which factor is concrete and which abstract?

8. 6 × $8 = $48. How many numbers are used in this example? Which of them are like numbers? Can you tell why?

9. Which is more, 2 × 3 × 4 inches or 3 × 4 × 2 inches? Prove it.

Remember these

Principles in Multiplication.—1. *Only one factor can be concrete.*

2. *The product and the concrete factor must be like numbers.*

3. *The order in which the factors are used will not affect the product.*

Show how these principles are illustrated in these examples:

10. 6 lb. at 8¢ cost ——. **11.** In 6 weeks there are —— days.

12. Compare 6 × 7 × 8, 8 × 6 × 7, and 8 × 7 × 6.

73. — Multiplication.

ORAL.

1. 6 × 4? 6 × $4?
2. 8 × 9? 8 × 9 lb.?
3. 7 × 8? 7 × 8 qt.?

4. 5 × 40? 5 × $40?
5. 6 × 20? 6 × 20 days?
6. 7 × 90? 7 × 90 tons?

7. What are two unequal parts of 12? Two equal parts?
8. ⁓ × ⁓ = 21; ⁓ × ⁓ = 63; ⁓ × ⁓ = 54; ⁓ × ⁓ = 45.
9. ⁓ × ⁓ = $21; ⁓ × ⁓ = $63; ⁓ × ⁓ = 54 pt.; ⁓ × ⁓ = 45 lb.
10. What two numbers multiplied together make 28? 35?
11. 18 is the product of what two numbers? What other two?
12. 49 is the product of what? 56? 81? 84? 96? 100?
13. $49 is the product of what? $56? 81¢? 84 miles?
14. Give the two factors of 56; 60; 48; 72; 108; 144.
15. Give the two factors of $56; $77; 121 feet; 120 inches.
16. 120 = 2 × ⁓; $120 = 2 × ⁓. **17.** 320 = 4 × ⁓; $320 = 4 × ⁓.

WRITTEN.

18. How many days are there in 352 weeks?

$$\begin{array}{r} 7 \text{ days} \\ \underline{352\phantom{\text{ days}}} \\ 14\phantom{\text{ days}} \\ 35\phantom{0\text{ days}} \\ \underline{21\phantom{00\text{ days}}} \\ 2464 \text{ days} \end{array} \qquad \begin{array}{r} 352\phantom{\text{ days}} \\ \underline{7 \text{ days}} \\ 2464 \text{ days} \end{array}$$

Explanation. 1 week is 7 days; 352 weeks are 352 × 7 days, or 2464 days. We save 6 figures in the work by using the smaller factor 7 as the multiplier; 7 × 352 = 352 × 7. Nevertheless, we must think and talk of the *concrete* factor, 7 days, as one of the 352 equal numbers to be put together.

19. In 425 weeks how many days?
20. How many feet in 785 yards?
21. What will 187 tons of coal cost at $6 a ton?
22. How many clothespins in 649 dozen?

Find the cost of

23. 257 yards at $4
24. 644 chairs at $3
25. 197 desks at $5

26. 623 volumes at $7
27. 865 tons at $9
28. 1479 barrels at $6

74.—To Multiply or Divide by 10, 100, etc.

ORAL.

1. What is the difference between 10 × 8 and 8 × 10?

2. 10 × 6 = ⁓; 6 × 10 = ⁓; 10 6's are ⁓; 6 10's are ⁓.

3. $\frac{1}{10}$ of 80? $\frac{1}{10}$ of 60? $\frac{1}{10}$ of 120? $\frac{1}{10}$ of 100?

4. What shall we annex to 8 to get 80? 80 is how many times 8? What is the effect of annexing a zero to 8? Of removing the zero from 80?

5. If annexing a zero to 8 multiplies it by 10, how may you multiply 7 by 10? 9 by 10? 12 by 10?

6. 10 × 13 = ⁓; 10 × 15 = ⁓; 10 × 25 = ⁓; 10 × 37 = ⁓.

7. If removing the zero from 80 divides it by 10, how may you divide 90 by 10? 70 by 10? 120 by 10?

8. $\frac{1}{10}$ of 60 is ⁓; $\frac{1}{10}$ of 110 is ⁓; $\frac{1}{10}$ of 130 is ⁓; $\frac{1}{10}$ of 150 is ⁓.

How many are

9. 10 × 23?

10. 10 × 75?

11. 10 × 49?

12. 10 × 68?

13. $\frac{1}{10}$ of 230?

14. $\frac{1}{10}$ of 750?

15. $\frac{1}{10}$ of 490?

16. $\frac{1}{10}$ of 680?

17. Are 6 × 1 hundred 600? What is the difference between 6 × 100 and 100 × 6? Then 100 × 6 = ⁓.

18. To get 600, what do we annex to 6? 600 are how many times 6? By what do we multiply 6 when we annex two zeros?

19. Multiply 7 by 100; 8 by 100. How do you do this?

20. If 100 × 6 = 600, what is $\frac{1}{100}$ of 600?

21. Removing one zero from 600 divides it by what? Removing *two* zeros from 600 gives ⁓, and is the same as taking $\frac{1}{100}$ of it, or dividing it by ⁓.

Multiply

22. 18 by 10

23. 27 by 10

24. 63 by 10

25. 95 by 10

26. 5 by 100

27. 25 by 100

28. 32 by 100

29. 76 by 100

Divide

30. 760 by 10

31. 890 by 10

32. 420 by 10

33. 640 by 10

34. 800 by 100

35. 1200 by 100

36. 6500 by 100

37. 8700 by 100

WRITTEN.

1. What will 500 tons of hay cost at $17 a ton?

Work.
$17
500
$8500

Explanation. 500 tons will cost 500 × $17. 500 = 100 × 5, 500 × $17 is the same as 100 × 5 × $17. Multiplying $17 by 5, we get $85. We multiply $85 by 100 by annexing two zeros, and get $8500, the cost of 500 tons.

What will be the cost

2. Of 70 tons at $18?
3. Of 40 tons at $16?
4. Of 600 tons of coal at $5.75?
5. Of 800 cords of wood at $12.25?

Multiply

6. $6.18 by 20
7. $4.55 by 30
8. 9.62 by 50
9. $35 by 500
10. $62 by 700
11. $49 by 800
12. $27.19 by 200
13. 6.47 by 300
14. 8.29 by 400

15. What will 37 lb. of butter cost at $0.25 a pound?

Remark. 25 cents may be written $0.25. In writing cents after $ it is best to place a zero before the point to show that there are no dollars. *Always separate dollars from cents by the decimal point.*

What will be the cost of

16. 37 gal. oil at $0.19?
17. 48 bu. oats at $0.59?
18. 59 yd. silk at $0.87?
19. 64 yd. carpet at $0.97?
20. 75 lb. tea at $0.63?
21. 89 lb. coffee at $0.55?

Find the entire cost of the following purchases:—.

22. 3 doz. eggs at $0.25
    2 gal. molasses at $0.45
23. 5 cans tomatoes at $0.13
    6 cans corn at $0.14
24. 3 yd. ribbon at $0.37
    6 yd. cambric at $0.14
    9 yd. cotton at $0.12
25. $\frac{1}{2}$ lb. nutmegs at $0.80
    3 lb. raisins at $0.35
26. $1\frac{1}{2}$ lb. steak at $0.30
    6 lb. codfish at $0.15
27. 8 lb. cheese at $0.16
    13 qt. milk at $0.12
    5 pints milk at $0.15

76.—Miscellaneous Exercises.

ORAL.

1. What change ought you to receive from a quarter-dollar after paying for 4 oranges at 4 cents each?

2. $23 = 19 +$ 〰
3. $49 =$ 〰 $\times$ 〰
4. $100 =$ 〰 $+ 25$
5. $27 \div$ 〰 $= 3$
6. $\frac{1}{8}$ of 64 is 〰
7. 9 is $\frac{1}{9}$ of 〰
8. $17 + 13 = 25 +$ 〰
9. How many pecks in $\frac{1}{2}$ bushel?

10. What shall I pay for 8 2-cent stamps and 5 postal-cards?

11. A 2-cent stamp will carry an ounce letter across the continent. What will it cost to send 25 letters a thousand miles?

12. I have 3 coins worth 35 cents; one of them is a silver quarter. What are the other two?

Find the cost of

13. 7 pails at 12¢.
14. 9 combs at 11¢.
15. Two brooms at 30¢ and 25¢.
16. $\frac{1}{2}$ pound of pepper at 18¢.

17. I can buy 5 railroad tickets for a dollar. What is this apiece?

18. At $7 a week, how many weeks can I board for $63?

19. What will 15 days' board cost at $7 a week?

20. How many chains at $3 each can I buy for $20?

21. My purse contains a quarter and 4 dimes. How much money have I after spending 20 cents?

22. What cost 17 eggs at 12 cents a dozen?

23. What will $\frac{1}{4}$ of a pound of chocolate caramels cost at $0.36 a pound? $\frac{3}{4}$ of a pound?

How many

24. Weeks in 56 days?
25. Pecks in 40 quarts?

How many

26. Feet in 96 inches?
27. Feet in 12 yards?

28. If a tree lives 17 years more, it will be 42 years old. How old was it 5 years ago?

WRITTEN.

1. When 1 ton of coal costs $5.75, 24 tons will cost 24 × $5.75, or ⁓?

What will be the cost

2. Of 19 tons at $6.28?

3. Of 27 tons at 7.64?

4. Of 93 bbl. flour at $4.75?

5. Of 78 bbl. flour at 5.67?

Multiply	How many are	Find the product of
6. $3.87 × 42	**9.** $9.87 × 123	**12.** 345 × $6.49
7. 75 × $4.93	**10.** 846 × $6.49	**13.** 678 × $5.87
8. 69 × $8.43	**11.** 927 × $5.28	**14.** 925 × $6.93

Work.

$$\begin{array}{r} \$318 \\ \underline{203} \\ 954 \\ \underline{63600} \\ \$64554 \end{array}$$

15. Find 203 times $318.

Explanation. 203 = 200 + 3; 203 × $318 = 3 × $318 + 200 × $318. 3 × $318 = $954; 200 × $318 = $63600. The sum of $954 and $63600 is $64554. In practice we omit the zeros in the second partial product.

16. In the 15th problem how many equal numbers did we put together into one product? This number is called the **Multiplier.**

17. In the 8th problem what was one of the 69 equal numbers we are required to put together? This number is called the **Multiplicand.**

18. The multiplicand and the multiplier are the **factors** of the product, because they *make* it.

What are the factors in the 1st problem? What does each one show?

Find the product made by these factors:—

19. 509 × 648
20. 704 × 945
21. 157 × 893
22. 395 × 647
23. 809 × 694
24. 907 × 648
25. 876 × 394
26. 507 × 849
27. 494 × 608
28. 994 × 889
29. 897 × 747
30. 689 × 984
31. 685 × 982
32. 849 × 698
33. 764 × 934

78.—Long Division.

1. $\begin{array}{r}9\underline{)243}\\27\end{array}$ **2.** $\begin{array}{r}8\underline{)784}\\98\end{array}$ **3.** $\begin{array}{r}11\underline{)704}\\64\end{array}$ **4.** $\begin{array}{r}12\underline{)912}\\76\end{array}$

In dividing in these four examples, some of the numbers used have been carried in the mind. Let us divide and *write all the numbers used* as follows:—

1. $\begin{array}{r}27\\9\overline{)243}\\\underline{18}\\63\\\underline{63}\end{array}$ **2.** $\begin{array}{r}98\\8\overline{)784}\\\underline{72}\\64\\\underline{64}\end{array}$ **3.** $\begin{array}{r}64\\11\overline{)704}\\\underline{66}\\44\\\underline{44}\end{array}$ **4.** $\begin{array}{r}76\\12\overline{)912}\\\underline{84}\\72\\\underline{72}\end{array}$

This method requires more figures, and hence is called *long* division, but we generally use it when the divisor is larger than 12.

Find the quotients and remainders in the following:—

1. 20)25 20)37 20)41 20)52 20)67 20)89 20)197
2. 20)101 20)111 20)126 20)149 20)159 20)163 20)192
3. 30)37 30)62 30)95 30)123 30)147 30)159 30)187
4. 40)58 40)90 50)108 60)185 50)216 80)425 90)285

5. How many times is 21 contained in 897?

$$\begin{array}{rl}42 & = \text{Quotient.}\\ \text{Divisor} = 21\overline{)897} & = \text{Dividend.}\\ \underline{84} & \\ 57 & \\ \underline{42} & \\ 15 & = \text{Remainder.}\end{array}$$

Explanation. We say 21 in 89 (tens) 4 (tens) times; place the 4 (tens) in the quotient over the 9 (tens); 4 (tens) × 21 = 84 (tens); 84 (tens) from 89 (tens) leaves 5 (tens); annexing the 7 from the dividend, we have 57; 21 in 57 2 times; place the 2 over the 7 of the dividend; 2×21=42; 42 from 57 leaves 15. The quotient is 42, and the remainder 15.

Divide these dividends by 21; 31; 41; 51; 61; 71; 81; 91:—

6. 364
7. 487
8. 592
9. 681
10. 793
11. 849
12. 975
13. 983
14. 846
15. 898
16. 949
17. 643
18. 1129
19. 1236
20. 1384
21. 1592
22. 2436
23. 3387
24. 4964
25. 5887
26. 6945
27. 7391
28. 6842
29. 7563
30. 8976
31. 9478
32. 6492
33. 8784
34. 9846
35. 8809

79.—Exercises in Division.

WRITTEN.

1. Find one-half of $476.84.
2. Divide $1386.28 into fourths.
3. What is $\frac{1}{3}$ of $897.39?
4. Find $\frac{1}{5}$ of $762.95.
5. What is one of the 6 equal parts of $6347.16?
6. How many times is $7 contained in $4976.37?
7. I lose $\frac{1}{8}$ of $2476.48. What have I left?
8. Divide $3468.25 among 9 men. What will each receive?
9. Separate 30,000 as nearly as possible into 11 equal parts.
10. Find $\frac{1}{12}$ of 87,392 pounds.
11. What is $\frac{1}{12}$ of 64,872 months?
12. How many dozen in 100,000?
13. How much larger is $\frac{1}{10}$ of 4800 than $\frac{1}{11}$ of 3575?

Find

14. $\frac{1}{42}$ of 9837
15. $\frac{1}{32}$ of 4872
16. $\frac{1}{52}$ of 8291

What is the quotient of

17. $3469 \div 62$
18. $8328 \div 73$
19. $5964 \div 82$

Divide

20. 8976 by 92
21. 3481 by 83
22. 5766 by 74

23. Divide 8008 by 26.

Work.

```
   308
26)8008
   78
   ---
    208
    208
    ---
```

Remark. The partial dividend 20 is smaller than the divisor 26. So we put 0 in the quotient, annex 8 to the 20, and say 26 in 208, 8 times.

Find the value of

24. $3496 \div 75$
25. $3942 \div 85$
26. $6847 \div 65$
27. $7891 \div 44$
28. $2345 \div 55$
29. $9876 \div 56$
30. $4642 \div 63$
31. $7831 \div 76$

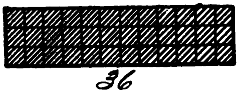
32. $39{,}416 \div 103$
33. $83{,}472 \div 113$
34. $19{,}842 \div 105$
35. $17{,}863 \div 121$
36. $19{,}831 \div 131$
37. $57{,}632 \div 143$
38. $28{,}931 \div 151$
39. $73{,}201 \div 173$

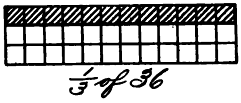
Divide

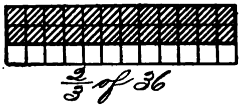
40. 289,876 by 125
41. 347,621 by 236
42. 456,932 by 381
43. 864,371 by 426
44. 698,428 by 573
45. 386,471 by 648
46. 694,328 by 901
47. 846,792 by 837

80. — Finding Parts of Numbers.

ORAL.







1. $\frac{1}{3}$ of 36 □'s is ⁓ □'s; $\frac{2}{3}$ of 36 □'s = 2 × ⁓ □'s, or ⁓ □'s.

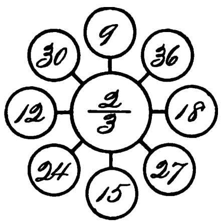
Find, in like manner,

2. $\frac{3}{4}$ of 48
3. $\frac{5}{6}$ of 30
4. $\frac{3}{7}$ of 28
5. $\frac{2}{5}$ of 45
6. $\frac{3}{8}$ of 24
7. $\frac{4}{9}$ of 27
8. $\frac{5}{7}$ of 35
9. $\frac{5}{8}$ of 48
10. $\frac{7}{9}$ of 63
11. $\frac{2}{9}$ of 45
12. $\frac{6}{7}$ of 42
13. $\frac{9}{10}$ of 70
14. $\frac{7}{9}$ of 72
15. $\frac{6}{7}$ of 49
16. $\frac{2}{3}$ of \$33
17. $\frac{5}{7}$ of \$63
18. $\frac{6}{11}$ of \$66
19. $\frac{7}{12}$ of \$84
20. $\frac{8}{11}$ of \$44
21. $\frac{6}{7}$ of \$56
22. $\frac{9}{10}$ of \$80
23. $\frac{8}{12}$ of \$24
24. $\frac{2}{3}$ of \$24
25. $\frac{9}{12}$ of \$72
26. $\frac{7}{10}$ of \$90
27. $\frac{5}{12}$ of \$108
28. $\frac{7}{12}$ of \$144
29. $\frac{4}{11}$ of \$121
30. $\frac{3}{4}$ of 400
31. $\frac{5}{6}$ of 600
32. $\frac{7}{8}$ of 400
33. $\frac{5}{9}$ of 270
34. $\frac{6}{7}$ of 350
35. $\frac{4}{11}$ of 1100
36. $\frac{10}{12}$ of 960

Note. — Some of the examples may be illustrated by diagrams.

37. Give the answers to the above examples at sight by lines or columns.

38.



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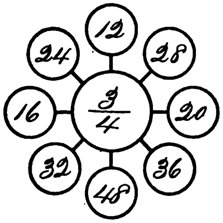

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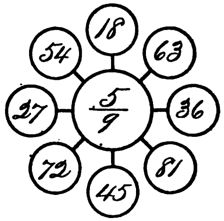


41.

$$\left.\begin{array}{r} 12 \text{ is } \frac{1}{2} \\ 8 \text{ is ⁓} \\ 6 \text{ is ⁓} \\ 4 \text{ is ⁓} \\ 3 \text{ is ⁓} \\ 2 \text{ is ⁓} \end{array}\right\} \text{of } 24$$

42.

$$\left.\begin{array}{r} 6 \text{ is ⁓} \\ 4 \text{ is ⁓} \\ 3 \text{ is ⁓} \\ 9 \text{ is ⁓} \\ 18 \text{ is ⁓} \\ 12 \text{ is ⁓} \end{array}\right\} \text{of } 36$$

43.

$$\left.\begin{array}{r} 6 \text{ is ⁓} \\ 4 \text{ is ⁓} \\ 8 \text{ is ⁓} \\ 12 \text{ is ⁓} \\ 16 \text{ is ⁓} \\ 24 \text{ is ⁓} \end{array}\right\} \text{of } 48$$

44.

$$\left.\begin{array}{r} 10 \text{ is ⁓} \\ 6 \text{ is ⁓} \\ 5 \text{ is ⁓} \\ 15 \text{ is ⁓} \\ 20 \text{ is ⁓} \\ 12 \text{ is ⁓} \end{array}\right\} \text{of } 60$$

WRITTEN.

	a.	b.	c.	d.	e.	f.	g.	h.	i.	j.	k.
1.	2	13	25	59	275	585	467	2398	5482	14,578	264,032
2.	5	19	31	62	364	673	389	3764	6947	25,657	589,175
3.	9	17	42	75	368	745	842	1509	7601	69,765	368,439
4.	7	20	35	86	409	884	547	4307	8379	41,980	898,764
5.	11	15	49	97	297	579	920	3649	9846	73,693	440,832
6.	4	21	27	79	497	981	308	6872	6912	39,816	793,761
7.	8	18	58	98	365	792	709	5259	8046	92,724	889,476
8.	6	14	33	76	587	653	600	2841	9367	56,539	695,749
9.	12	22	29	47	695	879	850	4936	7896	87,835	786,530
10.	3	16	67	99	473	987	936	7243	5843	78,454	929,763

Note. The direction "find the product of a × b" means that each number in column b is to be multiplied by the number on the same line with it in column a. Each direction furnishes ten examples. As many may be given as are needful.

Find the product of

1–10. a × h
11–20. a × i
21–30. a × j
31–40. a × k
41–50. b × c
51– 60. c × d
61– 70. b × f
71– 80. c × e
81– 90. c × g
91–100. d × f
101–110. d × g
111–120. e × f
121–130. e × g
131–140. f × g
141–150. d × h
151–160. c × i
161–170. d × i
171–180. e × i
181–190. e × h
191–200. g × h

Find the quotient of

1–10. h ÷ a
11–20. i ÷ a
21–30. j ÷ a
31–40. k ÷ a
41–50. e ÷ b
51– 60. f ÷ b
61– 70. g ÷ c
71– 80. h ÷ d
81– 90. h ÷ c
91–100. i ÷ d
101–110. j ÷ d
111–120. j ÷ c
121–130. k ÷ d
131–140. i ÷ f
141–150. j ÷ g
151–160. j ÷ f
161–170. j ÷ e
171–180. k ÷ f
181–190. k ÷ g
191–200. k ÷ i

82.—Division: its Two Uses.

ORAL.

1. If I separate 25 cents into 5 equal parts, what is the value of each part? $\frac{1}{5}$ of 25¢ = ∼∼ ¢.
2. Which of the two numbers in this problem is to be separated, or divided? What is it therefore called?
3. Which shows into how many equal parts the dividend is separated? What is it called? What is one of the equal parts called?
4. Into how many equal parts of 4 cents each may 28 cents be divided? 28¢ ÷ 4¢ = 7. Which is the dividend? The divisor? The quotient? Does the divisor or the quotient show the *number* of equal parts? What shows *size* or *value* of each part?

Two Uses of Division.

1st. *To find the* **size of one** *of the equal parts of the dividend.*

Illustration. What is $\frac{1}{8}$ of 72 cents?

Number of equal parts = $8\underline{)72\text{ cents}}$ = money to be divided.
9 cents = size of one part.

2d. *To find* **how many parts** *of a given size the dividend contains.*

Illustration. How many times is 9 cents contained in 72 cents?

Size of one of equal parts = $9\text{ cents}\underline{)72\text{ cents}}$ = money to be divided.
8 = number of equal parts.

In the following examples of division point out dividend, divisor, and quotient, and tell what each one shows.

5. $4\underline{)36}$ pounds
9 pounds

6. $\$5\underline{)\$65}$
13

7. $6\underline{)42}$ ft.
7 ft.

8. 12 ft.$\underline{)60}$ ft.
5

9. 96 pears ÷ 12 pears = 8.

10. $\frac{1}{9}$ of 63 gal. is 7 gal.

83.—The Two Uses of Division.

WRITTEN.

In these problems the *divisor* shows the *number* of the equal parts of the dividend, and the *quotient* shows the *size* of one part.

1. I have $4.75 to distribute among 9 boys. How much shall I give to each boy?

Explanation. As there are 9 boys, each one will receive $\frac{1}{9}$ of $4.75, or $0.52, and 7 cents will be left undivided.

2. I have 17 boxes and 300 books. How many books can I put into a box?

3. If a train of 23 cars carries 2000 tons, how many tons does each car carry?

4. What is $\frac{1}{28}$ of $113.97?

5. In a certain city there are 6216 school children and 148 teachers. What is the average number to a teacher?

6. Bought 127 tons of coal for $683.26. What was that a ton?

7. Separate 7237 men into 97 companies.

8. There are 1008 trees in a nursery, planted in 16 rows. How many trees in a row?

In these problems the *divisor* shows the *size* of one of the equal parts of the dividend, and the quotient shows the *number* of equal parts.

1. At $3 each how many chairs can I buy for $40?

Explanation. I can buy as many chairs as $3 is contained times in $40; $3 in $40 13 times. Hence, I can buy 13 chairs, and I shall have $1 remaining.

2. How many men can you hire for $38, at $4 each?

3. How many bushels are there in 115 pecks?

4. How many days are there in 208 hours?

5. How many boxes shall we need for 2000 blackboard crayons? A gross, or 144, are usually put into a box.

6. How many yards in 10,000 inches of rope?

7. How many loads of 537 bricks each will 72,000 bricks make?

8. How much remains after selling 17 tons of coal at $6.75 a ton, and buying as many coats as possible at $14 each with what is received?

84. — Division.

Separating a number into equal parts to find the value of one part.

1. Divide \$43.18 into 21 equal parts.

Work.

$$\begin{array}{r} \$2.05 \\ 21\overline{)\$43.18} \\ \underline{\$42.} \\ \$1.18 \\ \underline{\$1.05} \\ \$0.13 \end{array}$$

Explanation. In solving this example, two things must be observed.

1st. The decimal point in the quotient is *right over* the point in the dividend, and the point in the remainder is *vertically under* it.

2d. \$43.18 cannot be *exactly* divided into 21 equal parts, for we cannot divide \$0.13, the remainder, into 21 parts without cutting the coins.

$\frac{1}{21}$ of \$43.18 is \$2.05, with \$0.13 remaining undivided.

2. In the work of the preceding example, how many of the 7 numbers are concrete and represent money? Which is abstract? Is the remainder always a part of the dividend? Try to tell why the dividend, the quotient, and the remainder are like numbers.

Remember these

Principles in Division. 1. *The remainder and the dividend are always like numbers.*

2. *When the divisor is abstract, the dividend, the quotient, and the remainder are always like numbers.*

3. *When the divisor is an integer, the decimal points in dividend, quotient, and remainder are always in the same vertical line.*

Divide

3. \$70.76 into 23 equal parts.

4. \$66.79 into 32 equal parts.

5. \$43.73 into 41 equal parts.

6. \$98.40 into 14 equal parts.

7. What is $\frac{1}{32}$ of \$108.94?

8. Find $\frac{1}{45}$ of \$112.64.

9. What is $\frac{1}{36}$ of \$129.60?

10. Find $\frac{1}{48}$ of \$288.87.

11. Find $\frac{1}{63}$ of \$319.82.

85. — Division.

Showing into how many equal parts of a given size a number may be separated.

1. There are 25 envelopes in a bunch. How many bunches will 815 envelopes make?

Work.

$$
\begin{array}{rl}
 & 32 \\
25 \text{ envelopes}) & \overline{815} \text{ envelopes} \\
 & \underline{75} \text{ envelopes} \\
 & 65 \text{ envelopes} \\
 & \underline{50} \text{ envelopes} \\
 & 15 \text{ envelopes}
\end{array}
$$

Explanation. Here the divisor, 25 envelopes, shows the *size* of each equal part (or bunch), and the quotient will show into *how many* equal parts (or bunches) we can separate the 815 envelopes.

Dividing, we find that 815 envelopes contain 25 envelopes 32 times, with 15 envelopes remaining. Therefore we can make 32 bunches and have 15 envelopes towards making another bunch.

2. Of the 7 numbers in this example how many are concrete? Which is abstract?

Remember this

Principle in Division. 4. *When dividend and divisor are concrete, the quotient is considered abstract.*

When there are

3. 42 gallons in a barrel, how many barrels will 986 gallons fill?
4. 75 books in a box, how many boxes will hold 1218 books?
5. 218 bricks in a load, 3778 bricks will make how many loads?
6. 144 pens in a box, how many boxes will 10,000 pens fill?
7. 100 cards in a pack, how many packs in 8729 cards?
8. 24 hours in a day, how many days in 3675 hours?
9. 144 pencils in a box, how many pencils in 78 boxes?
10. 50 bottles in a case, how many cases will 12,786 bottles fill?
11. 208 peaches in a crate, how many are there in 99 crates?
12. 165 brads in a paper, 12,980 brads will fill how many papers?

86. — Miscellaneous Exercises.

ORAL.

Find what I paid in all for

1. 1 doz. eggs, 20¢
   1 lb. steak, 30¢
   1 gal. oil, 15¢

2. Ribbon, 12¢
   Braid, 8¢
   Thread, 17¢

3. 3 pt. milk at 4¢
   $\frac{1}{2}$ lb. butter at 30¢
   2 lb. cheese at 10¢

4. $\frac{1}{6}$ of \$42 is \$⁓; $\frac{5}{6}$ of \$42 is 5 × \$⁓, or \$⁓.

What is

5. $\frac{5}{6}$ of \$30?
6. $\frac{7}{8}$ of \$40?

What is

7. $\frac{3}{4}$ of 12 ft.?
8. $\frac{5}{6}$ of 12 in.?

What is

9. $\frac{9}{10}$ of 30 lb.?
10. $\frac{2}{3}$ of 21 books?

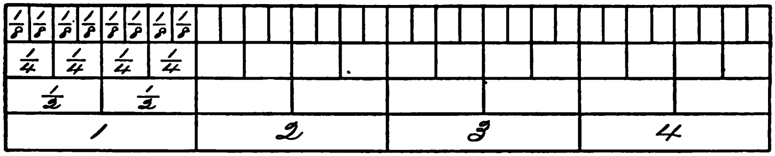
11. How many 9's in 16 + 65?
12. 800 + 70 + 5 = ?
13. How many minutes in 1 hour? In $\frac{1}{4}$ of an hour?
14. How many minutes from half-past 8 to 9 o'clock?
15. Frank's uncle gave him \$2.00, with which he bought a ball for \$1.10 and a bat for \$0.50. How much had he left?
16. Harry bought a sled for \$0.60, and gave the clerk a dollar bill. How may he have counted back the change?
17. If you take 12 steps in going 20 ft., how many will you take in going 40 ft.?
18. $\frac{1}{8}+\frac{5}{8}+\frac{1}{8}=$ ⁓
19. $\frac{1}{4}={}^{?}$; $\frac{1}{2}=\frac{?}{8}$; $\frac{1}{4}+\frac{1}{2}=$ ⁓
20. Charles weighed 56 pounds before vacation, and 68 pounds when he returned. What had he gained?
21. A grocer bought flour for \$5.85 a barrel, and sold it for \$6.00. How much did he gain?
22. My horse eats 6 quarts of oats a day. How long will 3 pecks last him? 3 × 8, ÷ 6 = ?

23. 100 = 37 + ⁓
24. 100 = 42 + ⁓
25. 67 + ⁓ = 100
26. 43 + 57 = ⁓
27. $\frac{4}{9}$ of \$72 = ⁓
28. \$8 is $\frac{1}{8}$ of \$⁓

29. Find the sum, difference, product, and quotient of 3 and 9.
30. Count by 25's from 0 to 200.
31. 100 − 37 = ⁓

87.—Fractional Length Measures.

ORAL.



1. How many inches in a foot? What part of a foot is here represented?
2. How many half-inches in one inch? In 2 inches? In 4?
3. How many quarter-inches in one inch? In 3 inches?

4. $\frac{1}{2}$ in. = $\frac{?}{4}$ in. 7. How many eighths of an inch in 1 inch?
5. $\frac{2}{2}$ in. = ? in. 8. How many eighths of an inch in $\frac{1}{2}$ inch?
6. $\frac{6}{2}$ in. = ⁓ in. 9. How many eighths in $\frac{1}{4}$ inch? In $\frac{3}{4}$ in.?
10. $1\frac{1}{2}$ in. + $1\frac{1}{2}$ in. = ⁓ 15. $\frac{6}{8}$ in. + $\frac{1}{8}$ in. + $\frac{1}{8}$ in. = $\frac{?}{8}$ in.
11. $2\frac{1}{2}$ in. + 1 in. = ⁓ 16. $\frac{3}{8}$ in. + $\frac{1}{4}$ in. = $\frac{?}{8}$ in.
12. $1\frac{1}{4}$ in. + $\frac{3}{4}$ in. = ⁓ 17. Cut $\frac{1}{2}$ inch off from a 4-inch rule,
and ⁓ inches will remain.
13. $\frac{1}{4}$ in. + $\frac{1}{8}$ in. = ⁓
14. $\frac{1}{2}$ in. + $\frac{1}{8}$ in. = ⁓ 18. 4 inches − $2\frac{1}{2}$ inches = ⁓

19. Cut a strip of paper 1 foot long and divide it into inches, half-inches, etc. Draw a line 3 feet long.

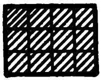
3 feet or ⁓ inches = **1 yard.**

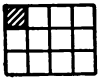
20. How many yards long is the longest blackboard in your school-room?
21. 4 inches are $\frac{1}{?}$ of 36 inches, or of a ⁓.
22. $\frac{2}{3}$ yd. = ⁓ ft. 23. $\frac{3}{4}$ yd. = ⁓ in. 24. $\frac{1}{2}$ yd. = ⁓ in.
25. How many quarter-inch spaces on a foot-rule?
26. How many half-inch spaces on a two-foot rule?
27. Draw a line $\frac{3}{4}$ inch long, one $\frac{1}{2}$ inch long, and another $\frac{1}{4}$ inch long. Now draw a fourth line as long as the first three put together. How long is it?
28. How long is your slate? Your desk? How wide?
29. Measure the width of the doorway in feet; in inches.
30. 3 ft. 6 in. = ⁓ inches. 31. $4\frac{1}{2}$ ft. = ⁓ inches.

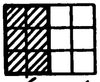
88. — Fractions.

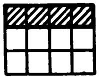
ORAL.

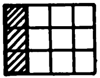
1. What are such numbers as $\frac{1}{2}$, $\frac{3}{4}$, $\frac{5}{8}$, $\frac{7}{8}$ called?
2. What is one of the four equal parts of a dollar called?
3. What is meant by $\frac{1}{3}$ of an apple? $\frac{1}{5}$ of a cake?
4. Draw a circle. How many 4ths in it? Erase $\frac{1}{4}$ of it. How many fourths remain? How do you write these fourths in figures?
5. Draw an oblong, or rectangle, and show what is meant by $\frac{6}{8}$? $\frac{6}{8}$ are how many 4ths? $\frac{6}{8}=\frac{?}{4}$?

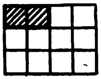

1 or $\frac{12}{12}$


$\frac{1}{12}$


$\frac{6}{12}$ or $\frac{1}{2}$


$\frac{4}{12}$ or $\frac{1}{3}$


$\frac{3}{12}$ or $\frac{1}{4}$


$\frac{2}{12}$ or $\frac{1}{6}$

6. What parts of the whole oblong are shaded? Which is the largest part shaded? The smallest?
7. Compare $\frac{1}{3}$ of the oblong with $\frac{1}{2}$ of it. Which is the larger? How much larger? $\frac{1}{2}=\frac{6}{12}$; $\frac{1}{3}=\frac{4}{12}$; $\frac{6}{12}-\frac{4}{12}=\sim\sim$
8. Compare $\frac{1}{3}$ and $\frac{1}{4}$ in the same way. Compare $\frac{1}{3}$ and $\frac{1}{6}$.
9. Compare $\frac{1}{4}$ and $\frac{1}{6}$. Compare $\frac{1}{2}$ and $\frac{1}{4}$. Compare $\frac{1}{2}$ and $\frac{1}{6}$.
10. $\frac{1}{12}+\frac{1}{12}+\frac{1}{12}+\frac{1}{12}=$ what? $\frac{2}{12}+\frac{3}{12}=$? $\frac{4}{12}+\frac{5}{12}=$? $\frac{4}{12}+\frac{3}{12}=$?
11. How many numbers are required to express a fraction? The two numbers needed to express a fraction are called its **terms**. Tell the terms of *three-fourths*. Of $\frac{6}{12}$.
12. Into how many parts is the whole oblong divided in the illustration? In the fraction $\frac{6}{12}$ which term shows this fact, 6 or 12? Which term shows the *name* of the parts?
13. In $\frac{6}{12}$ how many 12ths? Does the upper or the lower term show this?

The lower term *names* the equal parts in a fraction, and is called the **Denominator.**

The upper term shows the *number* of equal parts in a fraction, and is the **Numerator.**

WRITTEN.

1. Find the sum of the product and amount of 834 and 927.
2. If you should write 978 on your slate in a column 86 times and find the sum, what would it be?
3. What shall I pay in all for the following articles: —

15 yards of lace	at $1.25	per yard;
14 yards of silk	at 3.37	" "
42 yards of cotton	at 0.12	" "

4. Mr. A's income is $160 a month; his expenses are $856 per year. What can he save in a year?
5. What must you add to the sum of the smaller of these two columns to make it equal the larger?

$346.94	$732.98
276.31	763.25
1186.95	89.94

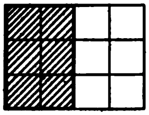
6. Find the cost of

20 tons of coal	at $7.25
9 cords of wood	at 9.85

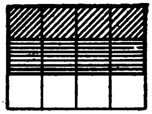
7. How many 5-inch badges will 20 yards of ribbon make?
8. $476 \times 809, -7645, +982 =$?   9. $\frac{1}{275}$ of $4675 = ?
10. A man who has 11,645 pounds of coal to put into a bin used a basket holding 85 pounds. How many basketfuls does he carry?
11. A farmer sells his apples at $1.25 a barrel. If he pays 15¢ a barrel for picking and 20¢ for the barrel, how much does he make on 75 barrels?
12. What shall I gain by buying a horse for $186 and selling it for $\frac{1}{2}$ as much more?
13. What do I pay a month for house rent at $300 a year?
14. The product is 40,000; the multiplier is 80. What is the multiplicand?

90. — Fractions.

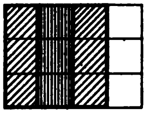
ORAL.



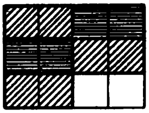
$\frac{1}{2}=\frac{6}{12}$



$\frac{2}{3}=\frac{8}{12}$



$\frac{3}{4}=\frac{9}{12}$



$\frac{5}{6}=\frac{10}{12}$

1. Cut a strip of paper 1 ft. long into pieces 1 in. long. How many pieces have you? What is meant by $\frac{1}{12}$ of a foot?

2. What is meant by $\frac{3}{12}$ of a foot? What does each term show? Name each term of $\frac{4}{12}$.

3. What part of a foot is 1 in.? 2 in.? 3 in.? 6 in.?

4. Add $\frac{2}{12}$, $\frac{3}{12}$, and $\frac{5}{12}$; $\frac{1}{12}$, $\frac{6}{12}$, $\frac{4}{12}$; $\frac{2}{12}$, $\frac{7}{12}$, $\frac{3}{12}$.

5. $\frac{1}{4}+\frac{1}{3}=\frac{3}{12}+\frac{4}{12}=\frac{?}{12}$. $\frac{3}{12}$ and $\frac{4}{12}$ are *like* fractions because their ——tors are *alike*.

Are $\frac{1}{3}$ and $\frac{1}{4}$ *like* fractions? Give your reason.

6. Add $\frac{1}{2}$ and $\frac{1}{12}$. **7.** Add $\frac{1}{4}$ and $\frac{1}{12}$. **8.** Add $\frac{1}{3}$ and $\frac{1}{12}$.

9. Which is larger, $\frac{1}{2}$ or $\frac{6}{12}$? Prove that what you say is true.

10. $\frac{2}{3}$ of 12 is ——; $\frac{2}{3}$ of a foot = —— in.; $\frac{8}{12}$ of a foot is —— in. Compare $\frac{2}{3}$ and $\frac{8}{12}$.

11. Compare $\frac{3}{4}$ and $\frac{9}{12}$. **12.** Compare $\frac{5}{6}$ and $\frac{10}{12}$.

Draw oblongs to illustrate some of these examples:—

13. $\frac{1}{2}=\frac{?}{12}$
14. $\frac{1}{3}=\frac{?}{12}$
15. $\frac{1}{4}=\frac{?}{12}$
16. $\frac{1}{6}=\frac{?}{2}$
17. $\frac{2}{3}=\frac{?}{12}$
18. $\frac{3}{4}=\frac{?}{12}$
19. $\frac{5}{6}=\frac{?}{12}$
20. $1=\frac{?}{12}$
21. $\frac{1}{2}-\frac{1}{12}$
22. $\frac{1}{3}-\frac{1}{12}$
23. $\frac{1}{4}-\frac{1}{12}$
24. $\frac{1}{6}-\frac{1}{12}$
25. $\frac{2}{3}-\frac{1}{12}$
26. $\frac{3}{4}-\frac{1}{12}$
27. $\frac{5}{6}-\frac{1}{12}$
28. $\frac{1}{2}-\frac{1}{3}$
29. $\frac{1}{3}-\frac{1}{4}$
30. $\frac{2}{3}-\frac{1}{4}$
31. $\frac{3}{4}-\frac{2}{3}$
32. $\frac{5}{6}-\frac{3}{4}$

33. $\frac{1}{2}$ ft. = —— inches; $\frac{3}{4}$ ft. = —— inches; $\frac{1}{2}$ ft. + $\frac{3}{4}$ ft. = —— inches.

34. 6 in. + 9 in. = —— inches; 15 in. = 1 ft. and —— inches.

35. $\frac{6}{12}+\frac{9}{12}=\frac{?}{12}$; $\frac{15}{12}=1\frac{3}{12}$. **36.** $\frac{17}{12}=$ ——.

37. $\frac{3}{4}$ of a dollar and $\frac{1}{2}$ dollar are —— fourths of a dollar, or $1 and ——. 3 silver quarters + a half-dollar = ——.

38. $\frac{1}{2}+\frac{2}{3}$
39. $\frac{3}{4}+\frac{1}{2}$
40. $\frac{2}{3}+\frac{3}{4}$
41. $\frac{2}{3}+\frac{5}{6}$
42. $\frac{3}{4}+\frac{5}{6}$
43. $\frac{5}{6}+\frac{1}{2}$
44. $\frac{1}{2}+\frac{1}{3}+\frac{1}{4}$
45. $\frac{3}{4}+\frac{1}{3}+\frac{1}{2}$
46. $\frac{2}{3}+\frac{1}{2}+\frac{1}{4}$
47. $\frac{2}{3}+\frac{3}{4}+\frac{5}{6}$

91.—Miscellaneous Examples.

WRITTEN.

1. Use 10,475 and 25 in finding a sum, a difference, and a quotient, and add the results.
2. At 2 cents each, what will be received for 94,287 newspapers?
3. In a school there are 12 classes, and an average of 50 pupils in a class. If every one in the school should make 500 straight marks on each side of his slate, how many would be made in all?
4. How many ounces in a pound? If this book weighs 8 ounces, how many pounds will 2500 like it weigh?
5. Lawrence's father allows him $1.50 a month for spending money. How long will it be before he can buy a printing press that costs $36?
6. If 2 quarts of berries will make a tumbler of jelly, how many tumblers will 2½ bushels of berries make?
7. Edward Wiswell went to town with ten dollars, and made the following purchases. What had he left?

3 quires of paper at $0.20
6 bunches of envelopes at $0.10
1 fountain pen, $1.25
1 pair of shoes, $3.50
2½ lb. of tea at $0.75
2 car-tickets at $0.15

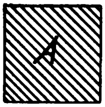
8. A trader counts the money he has received during the day, and finds he has 208 half-dollars, 73 quarters, 118 dimes, 42 nickels, and 13 cents. How much has he received in all?
9. A lot of land is 150 ft. long and 50 ft. wide. Draw an oblong 3 in. by 1 in. to represent it. How many feet of wire shall I need to surround it three times?
10. Ten thousand pounds of flour will fill how many barrels, if 196 pounds are put into each barrel?
11. How many weeks in the first 3 months of a leap year? [See p. 53.]
12. If I pay $0.06 for the use of a dollar for a year, what shall I pay for the use of $275?

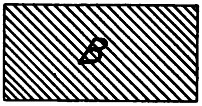
92.—Surface Measures.

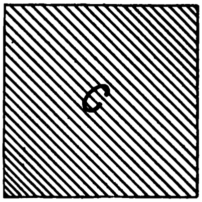
ORAL.

We measure ⁓ in inches and feet.

We measure **Surfaces** in *square inches* and *square feet.*







1. How many sides has a square? How do they compare in length?
2. How many angles, or corners, has a square? How do they compare in size?

The angles of a square are called *right angles.*

Flat surfaces with straight sides and four right angles are **Rectangles.**

3. Is *A*, at the right, a rectangle? Why? Is it a square? Why?

A square has ⁓ straight sides and four ⁓ angles.

4. Are *B* and *C* rectangles? Are they squares? Are all squares rectangles? Are all rectangles squares?
5. Draw three rectangles of different size that are not squares. How do they differ from squares?

Rectangles that are not squares are **Oblongs.**

6. What is *B*? How many oblongs on page 47?
7. Cut a square out of paper. How many squares on the paper? Do surfaces weigh anything? What would a thousand squares weigh?

Lines have *one* dimension, *length.*

Surfaces have *two* dimensions, *length* and *width.*

8. Compare the lengths of *A* and *B*. Compare their surfaces.
9. Compare the lengths of *A* and *C*. How do their surfaces compare?
10. Compare the sum of the bounding lines of *A*, *B*, and *C*.

93.—Surface Measures.

ORAL.

1. Measure the length and width of *C* on the opposite page. How long is it? How wide? What is its shape?
2. *C* is a **square inch.** Describe a square inch.
3. Out of paper cut a square an inch long. What does the surface of each side measure?
4. Draw an oblong 2 inches long and 1 inch wide. Use your paper square to find the number of □-inches in it. How many are there?
5. Draw a square 2 inches long. How many □-inches in it? How long is it? How wide? Should you call it a two-inch square? Why?
6. What is the difference between a two-inch square and two square inches?
7. Draw a three-inch square. Divide it into one-inch squares. Draw an oblong 3 inches long and 1 inch wide.
8. How many square inches in the surface of each of the figures you have drawn?
9. How does a three-inch square compare in size with three □-inches? Compare their dimensions.
10. Draw a four-inch square and find its area, or the number of □-inches it contains.
11. Draw a 5-inch square, and find its area in square inches.
12. Draw a 6-inch square, and an oblong containing 6 □-inches. How many times larger is one than the other?
13. Draw a 7-inch square, and divide it into inch-squares. How many □-inches in a row on one side? How many *rows* of these squares in the 7-inch square? How many □-inches in its surface?
14. If each small square in the larger square on page 42 represents a □-inch, how many square inches does the larger square contain?

94.—Miscellaneous Exercises.

ORAL.

1. A man makes 4 pairs of shoes in a week. What part of the work does he do in a day?
2. If you sleep $\frac{1}{3}$ of your time, how many hours do you sleep every week?
3. When brooms are 25 cents each, how many can be bought for $3?
4. What is my weekly milk bill if I take 2 qt. daily at 10 cents a quart?
5. What will 23 type-writers cost at $100 each?
6. Dr. French pays $8 a month for his telephone. What is that a year?
7. James Rich buys a bicycle for $75, agreeing to pay $11 down and $8 a month afterwards. How long before he will have paid all he owes?

Here are the cash accounts of three girls. How much money has each?

8. Mary.		9. Edna.		10. Lucy.	
Received.	**Paid out.**	**Received.**	**Paid out.**	**Received.**	**Paid out.**
$0.25	$0.15	$0.18	$0.20	$1.00	$0.25
0.10	0.03	0.20	0.20	2.00	1.00
0.06	0.12	0.50	0.08	0.50	0.25

11. What will 8 pianos cost at $400 each?
12. A half-note in music equals how many eighth-notes?
13. If I should divide $5 equally between a boy and a girl, what would the girl receive?

Count the change back out of $2 for these goods:—

14. $\frac{1}{2}$ gal. vinegar at 30¢
1 bottle capers 37¢

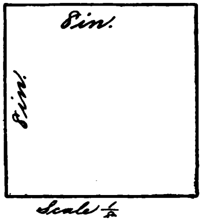
15. 5 lb. cottolene at 10¢
3 lb. codfish at 7¢

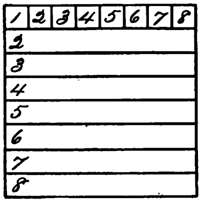
16. Miss True pays a quarter-dollar for every meal. What does she pay for breakfast, dinner, and supper for a week?
17. What shall I pay for 4 dozen buttonholes at 3¢ each?

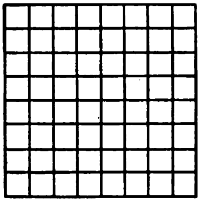
95.—To Find the Area of Rectangles.

WRITTEN.

1. What is the difference between an inch and a square inch?
2. Can we draw an 8-inch square on this page? Why? Below we have drawn an 8-inch square on a "scale of $\frac{1}{8}$"; that is, we have made its length and width $\frac{1}{8}$ of the *real* length and width. $\frac{1}{8}$ of 8 inches = 1 inch.



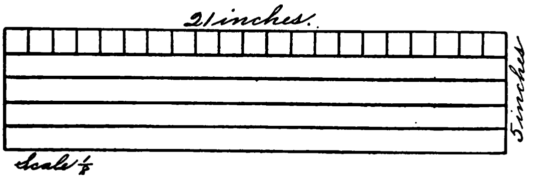




3. How many □-inches in the surface of an 8-inch square? *a.* Into how many oblongs 1 in. wide and 8 in. long can we divide an 8-inch square? *b.* How many □-inches does one of these oblongs contain? *c.* How many □-inches will all the oblongs contain?

Explanation. 1 oblong 8 in. by 1 in. contains 8 □-in.; 8 oblongs of the same size contain 8 × 8 □-in., or 64 □-in.

4. How many □-inches in an oblong 21 inches by 5 inches?



Suggestion. We may divide this oblong into ∼∼ smaller oblongs 1 inch wide and 21 inches long, each containing ∼∼ □-inches.

Draw these rectangles on a $\frac{1}{4}$ scale, and find the number of square inches in each:—

5. 12 in. long and 5 in. wide.
6. 9 in. long and 7 in. wide.
7. 16 in. long and 12 in. wide.
8. 10 in. long and 7 in. wide.
9. 12 in. square.
10. 18 in. long and 4 in. wide.

96.— Miscellaneous Exercises.

ORAL.

1. Subtract twice the difference between 6 and 9 from their product.
2. Take the quotient of 3 into 12 from 7 times their difference.
3. Find the product of $\frac{2}{3}$ of 9 and $\frac{3}{4}$ of 12.
4. A lady having $5, spent $\frac{1}{10}$ of it for car fares. How much had she remaining?
5. A trader bought a bunch of 100 bananas for $4, and sold them for 5 cents each. How much did he gain?
6. A newsboy sells 10 papers daily. If he makes $\frac{1}{2}$ a cent on each, what does he earn in a week?
7. Cut $2\frac{1}{2}$ inches from a stick 7 inches long, and how long a piece will remain?
8. Draw an oblong, and show that $\frac{3}{4}$ and $\frac{6}{8}$ are equal.

Find the entire cost of

9. 3 yd. cotton at $0.12
$\frac{1}{2}$ yd. ribbon at 0.20

10. 7 lb. sugar at $0.07
$3\frac{1}{2}$ gal. oil at $0.10

11. A man started at noon to walk 30 miles. He walked till 6 o'clock at the rate of 4 miles an hour. How far was he from the end of his walk?
12. How many dozen eggs in a box of 100 eggs?

How many

13. Days in 12 weeks?
14. Weeks in 50 days?
15. Feet in 100 inches?

How many

16. Inches in $\frac{2}{3}$ of a yard?
17. Minutes in $1\frac{1}{4}$ hours?
18. Quarts in $2\frac{1}{2}$ gallons?

19. How many sides have 5 squares and 3 triangles?
20. In spelling 48 words Ellen Frye misses 4. What part of the whole does she miss?
21. Take $\frac{2}{3}$ of 24 from $\frac{1}{3}$ of 90.
22. At $1.60 a gallon, what will 3 pints of oysters cost?

97.—Miscellaneous Exercises.

WRITTEN.

1. What will 25 tons of coal cost if 4 tons cost $22.40?

Work.

4)$22.40 = cost of 4 tons
$5.60 = cost of 1 ton
25
2800
1120
$140.00 = cost of 25 tons

2. What shall I pay for 75 pairs of shoes if 3 pairs cost $11.25?

3. When 6 barrels of flour cost $31.68, what shall I pay for 87 barrels?

4. I pay $7 for 100 lb. of zinc. What will 729 lb. cost?

5. If I travel 1728 miles in 8 days, how far should I travel in 2 weeks at the same rate?

6. A steamer burns 453 tons of coal in 3 days. How many days will 1547 tons last her?

7. If 7 barrels of apples sell for $9.73, what will 275 barrels sell for?

8. One farmer gets $200 for his wood, and his neighbor gets $248. The price is $8 a cord. How many cords did they sell in all?

9. A steamer runs 576 miles in 24 hours. How far will she run in 136 hours?

10. How many days in 17,280 hours?

11. How many minutes are there in 179 hours?

12. Mr. Bacon gives his daughter Louise $150 to furnish her room. She pays $65 for a chamber set, $22 for a sofa, $16.25 for a bookcase, $31.62 for a carpet, and the rest for pictures. What did she pay for pictures?

13. How many square inches of glass will cover a picture 12 in. wide and 16 in. long? Draw a diagram on a scale of $\frac{1}{4}$.

14. How many inches of moulding will be needed for the frame?

15. A farmer sells 18 barrels of potatoes, each holding $3\frac{1}{2}$ bushels, at $0.75 a bushel. What does he receive?

98.—Dimes, Cents, Mills.

The Decimal Parts of a Dollar.

ORAL.

1. What is the smallest coin in our money?
2. What is the smallest silver coin? The largest?

3. $\frac{1}{10}$ of a dime = 〰
$\frac{3}{10}$ of a dime = 〰
$\frac{1}{10}$ of a dollar = 〰
$\frac{4}{10}$ of a dollar = 〰

4. $\frac{1}{100}$ of a dollar = 〰
$\frac{3}{100}$ of a dollar = 〰
$\frac{25}{100}$ of a dollar = 〰
$\frac{75}{100}$ of a dollar = 〰

5. 1 dime = $\frac{1}{?}$ of a dollar
3 dimes = $\frac{3}{?}$ of a dollar

6. 1 cent = $\frac{1}{?}$ of a dollar
45 cents = $\frac{45}{?}$ of a dollar

7. Compare the value of \$$\frac{1}{2}$, 50 cents, and \$0.50.
8. Compare the value of \$$2\frac{1}{4}$, \$$2\frac{25}{100}$, \$2.25, and 225 cents.
9. What is the common way of writing a number of dollars and cents? \$1, 3 dimes, 7 cents is written 〰.

Dimes are written in the first place at the right of the decimal point as *tenths* of a dollar, and cents in the second place as *hundredths* of a dollar.

10. Do we mention the dimes in reading a sum of money? Read, \$$3\frac{43}{100}$, or \$3.43.
11. Read as dimes and cents, and then as tenths and hundredths of a dollar: \$0.45; \$0.87; \$0.54.
12. Read first as cents, and then as hundredths of a dollar.
13. If 10 marbles cost 1 cent, 1 marble will cost ^{1} of a cent.
14. If 1 marble costs $\frac{1}{10}$ of a cent, what will 20 marbles cost?
15. $\frac{1}{10}$ of a cent is called a *mill.* How many mills make a cent? In 40 mills there are 〰 cents.
16. $\frac{1}{2}$ a cent = 〰 mills. $2\frac{1}{2}$ cents = \$0.025, or 2¢ 5 mills.
17. 10 mills = 1 〰; 100 mills = 1 〰; 1000 mills = 1 〰.
18. 20 mills = 2 〰; 300 mills = 〰; 5000 mills = \$〰.
19. Mills are written in the *third* decimal place as *thousandths* of a dollar. Read: \$4.375; \$0.625; \$0.063.

99. — Decimals.

ORAL.

Numbers written at the left of the decimal point are **integers.** They denote so many *whole* things.

Numbers written at the *right* of the decimal point denote *equal parts* of whole things. Because these equal parts are always *tenths*, *hundredths*, *thousandths*, etc., we call them *decimal* fractions, or more briefly, **decimals.**

1. How many entire dollars in $24.375? How many dimes, or *tenths*, of a dollar? How many cents, or *hundredths*, of a dollar? How many mills, or *thousandths*, of a dollar?

2. Read the following as dollars and hundredths of a dollar: $32.19; $47.08; $6.39; $216.48; $82.97; $64.48.

3. Read the following as dollars and thousandths of a dollar: $6.125; $8.375; $9.625; $0.875; $0.938.

4. Read the preceding numbers as dollars, cents, and mills.

Using the dollar sign, write the following numbers: —

5. 50 hundredths of a dollar

6. 75 hundredths of a dollar

7. 285 thousandths of a dollar

8. 625 thousandths of a dollar

Decimals are chiefly used in writing U.S. money to show cents and mills, the parts of a dollar. We sometimes use decimals to show tenths, hundredths, and thousandths of other things.

9. Draw a line a foot long. Erase 0.2 of it.

10. Draw a line 1 yard long. Divide it into tenths. Divide each tenth into tenths. Make a line 0.01 of a yard long.

11. Draw a line 5 ft. $3\frac{3}{8}$ in. long; it is 0.001 of a mile long.

12. Do you understand what is meant by 0.8 of a foot? 3.25 yards? 0.528 of a mile? 10.625 tons of coal?

13. 0.001 of a ton of coal would weigh 2 lb. What would 0.003 weigh?

14. Do you think $\frac{1}{1000}$, or 0.001, is a large or a small fraction?

100.—Exercises in Decimals.

WRITTEN.

Perform the following exercises in addition and subtraction:—

	1.	2.		3.	4.
5.	$385.75 –	$197.89	**9.**	84.673 miles –	18.795 miles
6.	497.32 –	283.97	**10.**	93.984 miles –	72.395 miles
7.	649.76 –	591.89	**11.**	72.356 miles –	28.973 miles
8.	858.85 –	643.92	**12.**	64.932 miles –	59.398 miles

Caution. Remember that in adding or subtracting decimals, the decimal point in the result will come directly under the other decimal points.

13. What shall I pay for 37 yards of ribbon at $0.62½ a yard?

Work.
$0.625
37
4375
1875
$23.125

Suggestions. ½ a cent = 5 mills. There will always be as many decimal figures in the product as in both factors together. As our money has no coins smaller than a cent, I cannot pay $23.12½, but shall have to pay $23.13. In business, final *results* are always given to the nearest cent, 5 mills or more counting as another cent. Answers in this book conform to this custom.

Find the cost of the following articles to the nearest cent:—

14. 23 yards at $1.37½
15. 19 gallons at $4.62½
16. 39 tons at $5.94½
17. 247 lb. at $0.09½
18. 49 barrels at $2.87½
19. 67 cords at $8.47½
20. 2481 lb. at $0.053
21. 549 doz. at \$0.12$\frac{7}{10}$

22. Books are $7.15 a dozen. What must I pay for *one ?*

Work.
12)$7.150
$0.595+

Remark. We use the sign + in the quotient to show that there is an undivided remainder. Why shall I have to pay $0.60 for my book?

What will 1 chair cost me if the price for a dozen is

23. $13.50? **24.** $16.75? **25.** $8.60? **26.** $27.84?

101.—The Effect of Moving the Decimal Point.

ORAL.

1. Review page 74. Annexing a cipher to 8 ⁓. it by 10. Removing two ciphers from 800 ⁓ it by ⁓.
2. The same figures are used in writing the following numbers: $0.20; $2.00; $20.0; $200. Is there a difference in value? What causes this difference?
3. In $0.20 which figure represents dimes? In $2.00 what does the figure 2 represent? 2 dollars are how many times 2 dimes? In $0.20 where does the decimal point come? In $2.00? What change in the value do we make by moving the point one place to the right?
4. Compare $0.01 and $1.00. $1.00 is ⁓ times ⁓.
5. Compare $0.05 and $5.00; $2.35 and $235.
6. What is 100 times $4.30? What is $\frac{1}{100}$ of $430?
7. What effect on the value of $4.30 has the changing of the place of the point so that the number is $430?
8. Moving the decimal point one place to the right multiplies by ⁓; moving it two places to the right multiplies by ⁓; moving it ⁓ places multiplies by 1000.

9. Compare $50.00 and $5.00. $5 is $\frac{1}{?}$ of $50. What change in the place of the point will give $\frac{1}{10}$ of $50?
10. Compare $500. and $5.00; $675. and $6.75.
11. $\frac{1}{100}$ of $500. is $5.00. What change in the place of the point shows this?
12. Moving the point two places to the left in $700. gives ⁓ dollars, and is the same as dividing by ⁓. $7. is $\frac{1}{100}$ of ⁓ dollars.
13. Moving the decimal point *one* place to the left ⁓ by 10; moving it *two* places to the left divides by ⁓; moving it ⁓ places divides by 1000.

102.—Multiplying and Dividing by 10, 100, etc.

ORAL.

Multiply	Divide	Find the value of
1. $84.00 by 10	5. $9725. by 100	9. $76.50 × 10
2. 6.50 by 100	6. 8.70 by 10	10. 75.00 ÷ 100
3. 0.05 by 100	7. 557. by 100	11. 0.64 × 10
4. 17.31 by 10	8. 356.80 by 100	12. $\frac{1}{100}$ of $850

Write the following as dollars, or dollars and cents, using the dollar sign:—

13. 630 cents	14. 1960 cents	15. 6000 mills	16. 24 cents
84 dimes	218 dimes	8400 mills	62½ cents

17. At $10 each, how many silver watches can I buy for $1800?

18. How many gold watches will $5000 buy at $100 each?

19. An insurance company spent $9400 for type-writers at $100 each. How many did it purchase?

20. 1000 boxes weigh 6000 lb. What does one box weigh?

21. If 100 men earn $300 in a day, what will 500 men earn in the same time?

22. 3 in 9 ∼ times. Multiplying both dividend and divisor by 2 we have 6 in 18 ∼ times; multiplying them both by 4 we have ∼ in ∼ 4 times; by 10, and we have 30 in 90 ∼ times.

23. How is the quotient changed when we *multiply* both dividend and divisor by the same number?

24. 12 in 48 ∼ times. Dividing both dividend and divisor by 2 we have 6 in 24 ∼ times; by 4, and we have ∼ in ∼ 4 times; by 12, and we have 1 in 4 ∼ times.

25. How is the quotient changed when we *divide* both dividend and divisor by the same number?

Remember this

Principle in Division. 5. *Multiplying or dividing both dividend and divisor by the same number does not change the quotient.*

103. — Division.

WRITTEN.

1. Divide 1280 by 80.

Work.
8|0)128|0
16

Suggestions. What effect has dropping the zero from 80? From 1280? What effect on the quotient has dividing both dividend and divisor by 10? We may shorten the process by cutting off both ciphers and saying, 8 in 128 16 times. What principle of division do we use in this example?

In the same way divide: —

2. 6510 by 70
3. 5940 by 90
4. 28,800 by 400
5. $960 by $320
6. $64,800 by $600
7. 42,000 by 7000

8. How many town lots will $14,400 pay for at $600 each?

9. If 70 horses are sold for $15,400, what is one sold for?

10. At $120 each, how many bicycles may be bought for $9600?

11. How many dollars and cents in $\frac{1}{4}$ of $91?

Work.
4)$91.00
$22.75

Remark. When the dividend is dollars and the quotient is to contain cents, two zeros must fill the place of cents in the dividend. If the quotient is to contain mills, or to be given to the nearest cent, three zeros must be used.

Divide, giving the quotient in cents: —

12. $375 by 62
13. $350 by 69
14. $725 by 83
15. $2275 by 78
16. $8493 by 219
17. $629 by 57

18. When balls are $14 a dozen, 1 ball will cost $\frac{1}{12}$ of $14.000, or $1.166+. What shall I have to pay for it?

Divide, giving the quotient to the nearest cent: —

19. $721 by 36
20. $849 by 87
21. $647 by 217
22. $1486 by 625
23. $82.95 by 19
24. $17.28 by 281

25. What will one sheep cost me if 47 cost $98.40?

104.—Division of Dollars by Cents.

ORAL.

1. Read the following sums of money as cents:—
   $1.00; $3; $2.50; $7; $4.28; $13.75; $15.
2. Read the following as dollars, or dollars and cents:—
   100 cents; 300¢; 412¢; 650¢; 500¢; 1835¢.
3. How many dimes in $1.00? In 60¢? In $1.60?
4. How many nickels in $2.50?

   Suggestion. One nickel = ∼ cents; $2.50 = ∼ cents; 5 cents in ∼ cents ∼ times. Hence $2.50 = ∼ nickels.
5. How many 2-cent stamps will $2 buy? How many 5-cent stamps? How many 4-cent stamps?
6. If you earn $0.30 a day, how long shall you be in earning $2.10? In earning $21?

WRITTEN.

7. At $1.25 each, how many books can I buy for $10?

Work.

$1.25)$10.00
  or   *or*
125¢)1000¢(8
  1000

Suggestion. When the divisor contains cents, it is better to change both dividend and divisor to cents before dividing. [See p. 102.] We may place the quotient at the right of the dividend when more convenient.

8. Divide $17.28 by $0.36
9. Divide 96.75 by 2.25
10. $17.10 ÷ $0.38 = what?
11. 101.25 ÷ 3.75 = what?
12. How many pounds of tea can I buy for $21 at $0.75 a pound?
13. When a hat costs $2.50, how many can be bought for $140?
14. If starch is $0.08 a pound, how much will $10 purchase?
15. At $0.32 for a can of soup, how many cans will $23.36 buy?
16. When coal is $5.75 per ton, how many tons do I purchase if the amount of my bill is $69?
17. How many months' rent will $500 pay if the rent is $12.50 per month?

WRITTEN.

1. Multiply the difference between 463 and 297 by the subtrahend, and divide the product by the minuend.
2. At $2.75 each, how many hats may be bought for $50, and how much money will be left?
3. What part of 2000 lb. is 2 lb.? What will 2 lb. of coal cost at $10 a ton?
4. How many screws can I buy for $2 at $0.001 each? How many gross?
5. Counting 365¼ days to a year, how many days from Oct. 21, 1492, to Oct. 21, 1892?
6. In dividing by 478, what is the largest remainder possible?
7. How many times does a good town clock strike in August? How many strokes of the bell in that time?

Find the amount of the following purchases. You may make out the bills if your teacher thinks best:—

8. 29 bars soap @ 7¢
17 p'k'gs soapine @ 19¢
35 lb. borax @ 18¢

9. 25 cans condensed milk @ 17¢
27 lb. chocolate @ 37¢
18 tins Dutch cocoa @ 59¢

10. A newsdealer buys 36 papers at 4¢, 25 papers at 7¢, and 13 magazines at 28¢. He gains $2.00 when he sells them. What does he receive for the lot?
11. Mr. Drew hauls 78 loads of earth, 18 loads of sand, and 105 loads of brick at $0.27 a load. What is the amount of his bill?
12. ⅔ of 24 = ⁓; ⅔ of 240 = ⁓; ⅔ of 2400 = ⁓; ⅔ of 24,000 = ⁓.
13. Find ⅔ of 3786. 14. What is ¾ of 5000?
15. How many ounce packages can be made of 17.9 pounds? How many 2-oz. packages?
16. There are 64 squares on a checker-board. The board is as long as it is wide. How wide is the board, if each square is 1½ inches long? ⁓ × ⁓ = 64; ⁓ × 1½ in. = ⁓.

106.—A Review of Weights and Measures.

ORAL. [See Tables on pp. 185 and 186.]

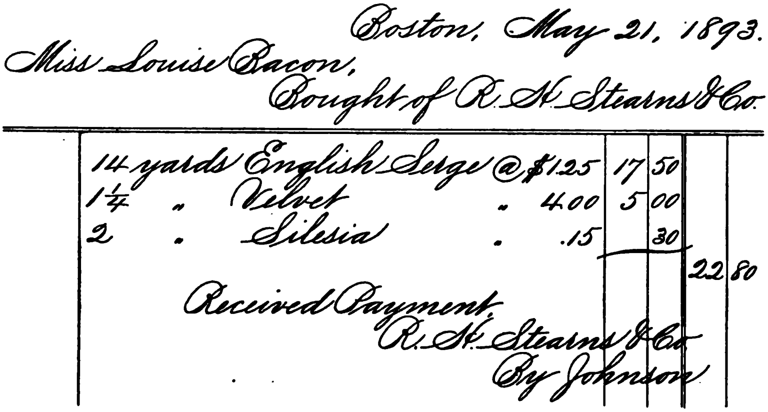
1. What is $\frac{1}{16}$ of a pound called? What part of a pound is 8 oz.?
2. What will 4 oz. of cloves cost at 16¢ a pound?
3. How many pounds in a ton of coal? In $\frac{1}{4}$ of a ton?
4. What will $\frac{1}{2}$ a ton of coal cost at 1¢ a pound?
5. Compare a pint, a quart, and a gallon.
6. A tumbler holds $\frac{1}{2}$ pint of jelly. How many tumblers will your mother need to put up 2 quarts?
7. A peck measure holds 20 large apples. How many will a bushel basket hold?
8. What will $\frac{1}{2}$ a bushel of potatoes cost at $0.25 a peck?
9. Charles Sharp gave $3 for a bushel of nuts, and sold them for 10 cents a quart. How much did he gain?
10. How often does the earth turn on its axis? What is $\frac{1}{24}$ of this time called?
11. What is $\frac{1}{60}$ of an hour called? How many times does a clock tick in a minute at the rate of once a second?
12. How long from midnight to noon? What part of a day?
13. In 49 days how many weeks?
14. How many calendar months in 4 years?
15. If you should save a cent a day, how much money would you have at the end of a year?
16. Compare an inch, a foot, and a yard.
17. A halter is 10 ft. long. How much less than 4 yards is that? Draw a line $\frac{1}{16}$ of a yard long.
18. Get a piece of string $16\frac{1}{2}$ ft. long. It is a rod long. How much less or more than 2 rods long is your school-room?
19. Tell the difference between squares and other rectangles.
20. Compare a 3-inch square and 3 □-inches.
21. Find the area of a square 9 inches wide.
22. Draw an oblong 9 inches long and 4 inches wide and show that it contains 36 □-inches.
23. Draw a square having 36 □-inches area.

107.—Bills.

WRITTEN.

1. In the following **Bill** what is the *date of purchase?* Who was the *buyer?* The *seller?* How many *items* does the bill contain?
2. Tell the *quantity*, *kind*, *price*, and *cost* of the first item. Of the second. Of the third.
3. What is the *amount* of the bill? Has the bill been paid and *receipted?* What was the name of the clerk that received the money?

Remark. The sign @ means *at* and precedes the *price* of one yard, pound, etc.



Boston, May 21, 1893.

Miss Louise Bacon,

Bought of R. H. Stearns & Co.

14 yards English Serge @ $1.25	17	50		
1¼ " Velvet " 4.00	5	00		
2 " Silesia " .15		30		
			22	80

Received Payment,
R. H. Stearns & Co.
By Johnson

4. Suppose Miss Bacon had bought the following articles at the same store: —

12 yards China silk @ $0.75
¾ yards black silk @ 2.00

Make out and receipt her bill.

Make out bills of the following sales, using your teacher's name as buyer, and the name of some merchant near you.

5. 23 lb. coffee @ $0.35
6½ lb. tea @ 0.50

6. 16 yd. gingham @ $0.42
4 doz. buttons @ 0.16

108. — Miscellaneous Exercises.

ORAL.

1. $\frac{1}{8}$ of my money is \$6. How much have I?
2. What is the value of $\frac{1}{2}$ of \$$\frac{1}{2}$? $\frac{1}{5}$ of \$$\frac{1}{4}$?
3. A clerk had the month of August for a vacation. He spent 2 weeks at the seaside, and the rest of the time at the mountains. How many days did he spend at the mountains?

4. $\frac{2}{3}$ of 36 = ⁓
5. 8 is $\frac{1}{9}$ of ⁓
6. $\frac{8}{10}$ of 100 = ⁓
7. $\frac{1}{3}$ of 45 = ⁓
8. 12 doz., or 1 gross = ⁓
9. $2\frac{1}{4}$ ft. = ⁓ inches.

10. What will it cost to launder 4 collars and 6 cuffs at $1\frac{1}{2}$ cents each?
11. What will 16 lemons cost at 24¢ a dozen?
12. How many months in a quarter of a year?
13. How many hours from 9 P.M. to 6 A.M.?
14. How many hours in $\frac{1}{2}$ an hour + 30 minutes + $\frac{3}{4}$ of an hour + 15 minutes?
15. Draw diagrams to show how much $\frac{1}{4}$ and $\frac{4}{16}$ differ.
16. What will $\frac{3}{8}$ of a pound of mace cost at 10¢ an ounce?

What shall I pay in all for

17. $1\frac{1}{2}$ gal. of oil at \$0.16
    $1\frac{1}{2}$ lb. of butter at 0.30
18. 6 yd. of cotton at \$0.10
    2 doz. buttons at 0.12

19. If you had a piece of cardboard 12 inches long and 8 inches wide, into how many pieces an inch square could you cut it? How many half-inch squares would it make?
20. There are 12 girls in a circle of King's Daughters. How many yards of ribbon will supply them with 6-inch badges?
21. Count by 25's to 200. Count back by 20's.
22. A square is 12 inches long. What may it be called?
23. If a quarter-note has two beats, how many will a half-note have? A dotted quarter?
24. If 4 cents is $\frac{1}{5}$ of my money, how much is the rest of it?
25. Add $\frac{2}{3}$ of a yard, 24 inches, and 2 feet.

WRITTEN.

1. Which of the two men named in the bill below *owes a debt*, or is a **debtor?**
2. Which is the **creditor** to whom *the debt is owed?*
3. Read the following, filling the blanks with the names used below:—

Mr. ∼ is a **debtor** (Dr.) to Mr. ∼ for $∼.
Mr. ∼ is a **creditor** (Cr.) of Mr. ∼ for $∼.

Washington, March 31, 1894.
Mr. Edward Emerson,
To Herman Strauss, Dr.

For 1 Term's Instruction in Music,
17 Lessons @ $1.25. $21.25

Make out these August milk-bills for Henry Farmer:—

4. Augustus Reed takes 2 quarts daily at 7 cents.
5. Simon Poor takes 1 qt. of milk and 1 pt. of cream daily. The cream is 20 cents a quart.
6. Ralph Barnes, a carpenter, does 3½ days' work for Rev. Amos Blanchard at $2.50, and furnishes 75 ft. of lumber at 3 cents. Make out Mr. Barnes's bill and receipt it.
7. Dr. Henry Pratt has made 12 visits at Mrs. Mary Paul's, whose daughter has been ill. His charge is $1.50 a visit. Make out his bill. He has furnished $2.75 worth of medicine.
8. Mr. Dennis Murphy has cut my grass and spaded up my flower-beds, charging $1.25 for one job, and ¼ day's work at $1.50 for the other. Use your own name as debtor, and make out the bill for him. Who should receipt the bill? How should his daughter receipt it?

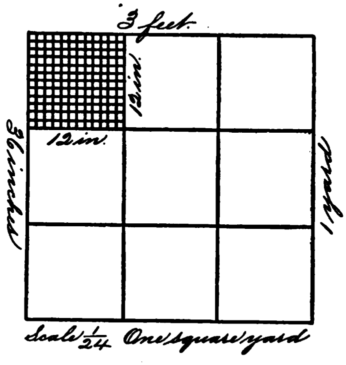
110. — Surface Measures.

ORAL.

1. Describe a square. Describe a square inch.
2. Draw an oblong containing 2 square inches. Draw a 2-inch square. Compare the size of their surfaces, their weight, and their perimeters. [The *perimeter* of a surface is the combined length of the lines that bound it.]
3. Draw a 3-inch square and an oblong containing 3 square inches, and make the same comparisons between them.
4. Draw a 2-inch square and a 4-inch square, and compare their lengths, their perimeters, and their surfaces.
5. How many 2-inch squares can you draw in a 6-inch square? How many $\frac{1}{2}$-inch squares in a 4-inch square?
6. Draw a square a foot long. What is its length in inches? Into how many oblongs an inch wide and 12 inches long may it be divided? Each of these oblongs contains how many square inches? How many square inches will they all contain?

A square a foot long is a **square foot.** It contains 144 square inches.

7. Cut a piece of paper a foot square, and divide the surface of one side into square inches.



Scale $\frac{1}{24}$. One square yard

8. On the blackboard draw a square a yard long. What should you call it?
9. Separate it into squares a foot long. How many square feet in a square yard?

Draw diagrams and find the area of oblongs that are

10. 12 feet long and 8 feet wide.
11. 16 feet long and 4 feet wide.

111.—Review Exercises.

WRITTEN.

1. What is the value of 218 dimes, 3756 cents, 185 nickels, 5000 mills, $32.75, and 1000 half-dollars?

2. Mr. Wise paid $1825 for a lot of land; he built a house costing $3728.75 more than the lot, and a stable that cost $729.58 less than the lot. Find the cost of all.

3. The sidewalk in front of my house is 48 ft. long and 8 ft. wide. Make a diagram representing it on a scale of $\frac{1}{8}$, and find the area of the walk in square feet.

4. My horse eats 8 quarts of oats a day. How many bushels will he eat in 80 days?

5. How many posts will be needed for 20 rods of fence if they stand $16\frac{1}{2}$ ft. apart? $16\frac{1}{2}$ ft. = 1 ⁓.

Make out and receipt bills for these articles: —

6. 78 lb. codfish @ 6¢
56 lb. halibut @ 18¢
2 bbl. herring @ $3.75

7. 5 gal. alcohol @ $2.32
8 gal. ammonia @ $$0.16\frac{1}{2}$
7 lb. camphor @ $0.48

8. How many square yards in a web of cloth a yard wide and 40 yards long? Into how many pieces a foot square might this cloth be cut?

9. The square of 6, or 6^2, or $6 \times 6 =$ ⁓. Find 275^2.

10. A boy rides to his work and back on his bicycle every day. How many miles does he ride in a year, allowing 52 Sundays and 7 holidays. He lives 8 miles from his work.

11. A contractor employs 7 men at $1.50 a day, 4 men at $2.50, and 3 boys at $3.00 a week. How much money will be needed to pay them all for a week's work?

12. What is $\frac{1}{1728}$ of 16 times 1728?

13. How many thousand in a million?

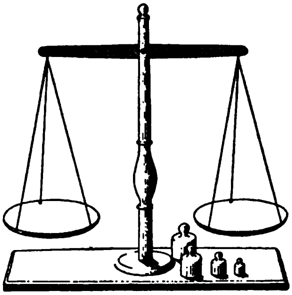
14. The tickets to a fair are 25 cents each. 120,000 people attend the fair, and the expenses are $27,356.82. What are the profits from sale of tickets?

112.—A Review.

ORAL.

1. Show with objects that addition and multiplication are ways of putting two or more numbers together into one.
2. Show that subtraction and division are ways of separating a number into parts.
3. Numbers to be added are sometimes called *addends*. What are the *terms*, or names of the numbers used, in addition? In subtraction? In multiplication? In division? In a fraction? Five of these names end in *end* or *and*, and five end in *er* or *or*. Try to find what these endings mean.
4. One addend is 12, and the amount is 26. What is the other addend? $\sim + 12 = 26$.
5. The subtrahend is \$16, and the remainder \$9. What is the minuend? $\sim - \$16 = \$9$.
6. The product is 48 rods. What are the factors? What is the multiplier? $\sim \times \sim = 48$ rods.
7. The quotient is \$8, and the divisor is 5. What is the dividend? $\frac{1}{5}$ of $\sim = \$8$.
8. The remainder in a division is always a part of what? What are like numbers?
9. $\$6 \times \sim = \$24$; $\sim \times 4 = \$24$. When one factor and the product are given, how do you find the other factor?
10. What is the area of a 2-inch square? Of a 4-inch square? What is the square of 2? Of 4?
11. 3^2 means the square of 3, or 3×3, or $\sim$.
12. What does 5^2 mean? $5^2 = \sim$. $6^2 = \sim$.
13. What is the side of a square that contains 4 □-inches? If it contains 16 □-inches?
14. A rectangle contains 20 □-inches, and is 4 inches wide. Study out a way of finding its length. Use a diagram.
15. $\frac{1}{6} + \frac{1}{4} = \sim$
16. $\frac{11}{12} - \frac{1}{3} = \sim$
17. $\frac{3}{4} + \frac{1}{12} = \sim$
18. $16 - 1\frac{3}{4} = \sim$
19. $3\frac{1}{2} + \frac{7}{8} = \sim$
20. $3\frac{1}{2} - \frac{5}{8} = \sim$

WRITTEN.



1. For what is a balance used? When are its scales level?
2. If one scale contains 12 oz., and the other 20 oz., how might you make them balance?
3. What is cash? Why should one keep an *account* of his cash?
4. In this cash account, what does the left or Dr. side show? The right or Cr. side?

Dr. (Received) Cash (Paid out) Cr.

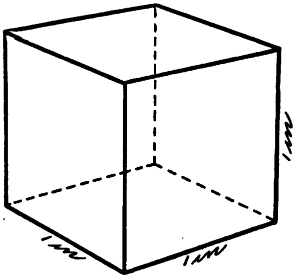
1894				1894,			
May 5	On Hand	15	00	May 6	By Shoes	4	75
7.	To Rent	12	50	8	. Hat	3	00
12	" Labor	5	75	21	. Balance		
20	. Mdse Sold	4	50				
		37	75			37	75
May 21	On Hand						

5. How much cash has been received, or what is the *footing* of the debtor side? What is meant by the first entry "On hand"? How much cash has been paid out?
6. If $37.75 in silver is in the left scale, and $7.75 in the right scale, how shall we make the scales balance?
7. If we add the difference between the two sides of an account to the smaller side, will the footings be equal?
8. Why is this difference called a "balance"?
9. How much money on hand May 21? Why do you think so? What do the double lines under the footing show?
10. Mr. Clark has on hand $12.75; he receives $3.50, $8.75, and $10; he pays out $4.62 and $7.85. What difference would make his cash account balance?

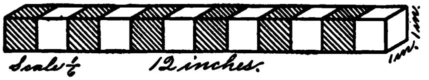
114.—Rectangular Solids.

ORAL.

1. How long is this page? How wide is it?
2. We measure distances in inches, ⁓, ⁓, or ⁓.
3. How would you measure the surface of this page?
4. **Lines** have *one* dimension only; namely, ⁓.
5. **Surfaces** have *two* dimensions; namely, ⁓ and ⁓.
6. What do lines and surfaces weigh? Do they occupy space? Try to tell why.
7. Objects that occupy space and have weight are called **Solids.** Solids have *three* dimensions, — length, ⁓, and thickness. Is this book a solid? Is a soap-bubble? Why?



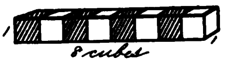
8. How many surfaces has the solid here shown? What is the shape of each?
9. A solid bounded by six square surfaces is a **Cube.** How many corners has a cube? How many edges?
10. If a cube is an inch long, how wide is it? How thick?
11. A cube an inch long is an inch cube, or a **cubic inch.** The contents or volume of some solids may be measured in cubic inches.
12. Are squares rectangles? Are oblongs rectangles? Why?
13. A solid bounded by six rectangles is a **rectangular solid.** What kind of solid is a crayon box? A brick? This room?
14. A rectangular solid with two square surfaces is a **square prism.** Does the figure at the left represent a rectangular solid? Why? Is it a square prism? Give your reason.

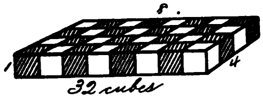


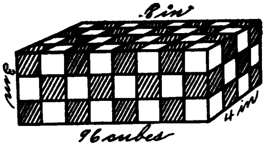
15. Into how many inch cubes, or cubic inches, might you cut a prism 1 inch square and 12 inches long?

WRITTEN.

1. What will be the contents in cubic inches of a prism 15 inches long, 1 inch wide, and 1 inch thick? If 2 inches wide?
2. How many inch cubes will be needed to make a rectangular pile 8 inches long, 4 inches wide, and 3 inches high?







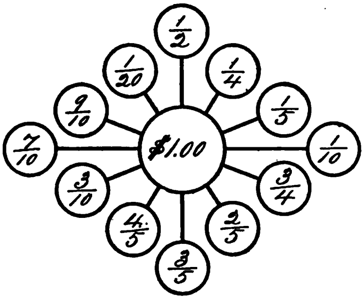
Suggestions. To make 1 row 8 inches long requires ⁓ cubes; to make a layer 4 inches wide will require 4 rows or 4 × ⁓ cubes or ⁓ cubes; to make a solid 3 inches high will require 3 layers or 3 × ⁓ cubes or 96 cubes.

3. How many inch cubes will be required to make a rectangular pile 7 inches long, 5 inches wide, and 2 inches high?
4. How many inch cubes are there in a pile 8 in. long, 4 in. wide, and 3 in. high?
5. How many inch cubes can be put into a box 5 in. long, 4 in. wide, and 3 in. deep?
6. How many inch cubes will a box contain if it is 9 in. long, 6 in. wide, and 5 in. deep?
7. What is the difference between an inch cube and a cubic inch?
8. How many cubic inches in a box 10 inches long, 8 inches wide, and 4 inches deep?
9. The three dimensions of a box are 12 in., 10 in., and 8 in. What are its contents in cubic inches?
10. I have 96 inch cubes; if I make a pile 8 inches long and 4 inches wide, how high can I make it?
11. Compare a 2-inch cube and a 4-inch cube as to length, area of side, and contents.

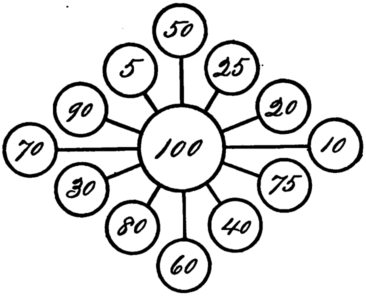
116.—Parts of Numbers.

ORAL.

1. How many cents in the following parts of a dollar?



2. What part of 100 is each number in the small circles?



3. On the blackboard draw a square 20 inches long. Draw lines to divide it into 100 smaller squares. With the side of the crayon, whiten two rows of squares. Ask your classmates to tell what *part* of the large square you have whitened? What part remains unwhitened?
4. Whiten other parts of the square, and tell what parts are whitened and what remain unwhitened.
5. Try to whiten or color any part of the square that your teacher may indicate.

To the Teacher. **The foregoing exercises suggest a simple line of objective work. Squares or rectangles may be subdivided at pleasure until the pupil understands clearly the relation of parts to the whole. He should be taught to express his fractions in smallest terms.**

6. Five cents is what part of $0.50? $0.45 is what part of $$\frac{1}{2}$?
7. Of a flock of 20 sheep, $\frac{1}{5}$ are black. How many are white?
8. Charles Morgan has $0.40 and spends 5¢. What part of his money does he spend? What part remains?
9. $\frac{1}{2}$ of 18 is $\frac{1}{6}$ of what number? **10.** 12 is $\frac{1}{8}$ of —.
11. Bought a bicycle for $40, and sold it so as to gain $\frac{1}{10}$ of the cost. What did I receive for it?

117. — Review Exercises.

WRITTEN.

1. How many square inches in one side of a pane of glass 15 inches long and 12 inches wide?
2. $\frac{5}{6}$ of 60 is? $\frac{5}{6}$ of 600 is? $\frac{5}{6}$ of 2400 is? $\frac{5}{6}$ of 1872 is?
3. Find the sum of $\frac{1}{9}$ of $25.29 and $\frac{1}{8}$ of $20.
4. Make a drawing to show the difference between a 5-inch square and 5 square inches.
5. In a pair of roller-skates 128 steel balls may be used. How many will be needed for 12 dozen pairs?
6. If a bicycle requires 105 steel balls for its bearings, and a firm uses 500,000 of these balls in a year, how many bicycles does it make?
7. Mr. Jones lets me use his horse for 80 cents an hour. What shall I pay him for his horse from 8 o'clock A.M. to half-past one P.M.?
8. Mr. Rich allows me to use a dollar of his money a year for 6 cents. What shall I pay him for the use of $200?
9. A station agent sells tickets as follows: —

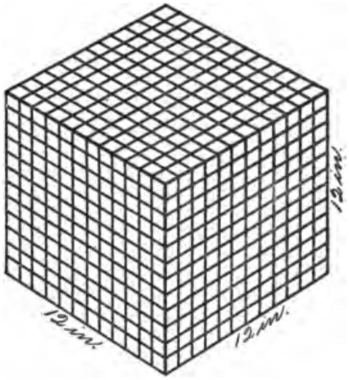
   17 at 8¢ 4 at 16¢ 16 at 32¢
   23 at 10¢ 21 at 25¢ 57 at 35¢

   How much money does he receive?
10. I received $600, $\frac{2}{3}$ of which came from a tenant for rent; the remainder was received for apples at $0.25 a bushel. How many bushels did I sell?
11. 25 men build a road in 24 days. How many days would 30 men have required?
12. A wire fence costs $5\frac{1}{2}$ cents a foot. What shall I pay for enough to fence a square field 200 feet long?
13. An engineer makes four round trips from Boston to Portland every week. If the distance is 90 miles, how many miles does he travel in 12 weeks?

118.—Measuring Solids.

ORAL.

1. We measure the contents of larger rectangular solids in foot cubes or **cubic feet.** Name some solids whose contents or volume might be measured in this way.



A cubic foot (Scale $\frac{1}{12}$)

2. The illustration at the left represents a cubic foot on a scale of $\frac{1}{12}$ of the real size. What is the height of the drawing? What is each dimension of a cubic foot in inches?

3. How many square inches in one side of a cubic foot?

4. How many cubic inches in a cubic foot?

Suggestions. Along one edge of the foot cube there is a row containing ∼ inch cubes; in the upper layer of the cubic foot there are ∼ such rows, or ∼ × ∼ cubic inches; as the cubic foot is ∼ in. high there are ∼ of these layers, or 12 × 12 × 12 inch cubes, or ∼ cubic inches. Hence there are

1728 cubic inches (cu. in.) in **1 cubic foot** (cu. ft.).

5. How many cubic inches in 2 cu. ft.? In 5 cu. ft.?
6. Suppose you should separate a foot cube into halves, how many cubic inches in each half? In $\frac{1}{4}$ of a cubic foot how many inches?
7. If you should divide a foot cube into 8 equal cubes, how many cubic inches would each one of them contain?
8. How many cubical blocks, each a foot long, would be needed for a pile 8 ft. long, 4 ft. wide, and 3 ft. high? [See illustration, page 115.]
9. A granite block is 5 ft. long, 2 ft. thick, and 3 ft. wide. How many cubic feet does it contain?
10. A block of marble 9 ft. long, and 3 ft. square at each end contains how many cubic feet?

WRITTEN.

1. Begin at 7890 and count as far as 7900. Find the sum of the 10 numbers you have named.
2. A gentleman whose house cost him $8476.75 sold it to a lady and gained $\frac{1}{5}$ of the cost. What did the lady pay for it?
3. How many inches in $\frac{25}{100}$ of a foot? In 2.25 ft.?
4. A ship has sailed 1375 miles, and is $\frac{1}{3}$ of the way home. How many miles more must she sail?
5. The capacity of a car is 19,500 lb. How many barrels of cement weighing 285 lb. each can it carry?

Find the balance on hand in each of these cash accounts:—

6.		**7.**		**8.**	
Received.	*Paid.*	*Dr.*	*Cr.*	*Dr.*	*Cr.*
$24.75	$3.79	$237.69	$376.21	$61.97	$46.21
18.62	18.84	184.27	8.49	83.25	92.83
29.34	62.25	62.91	12.62	964.39	75.97
86.92	19.27	99.89			62.75

9. There are $16\frac{1}{2}$ feet in a rod, and 320 rods in a mile. How many feet in a mile?
10. In going 8 times around a square park I walk 9600 feet. How long is the park? Make a diagram.
11. If a train goes 32 miles in an hour, how long will it be in going a thousand miles? Give the answer in hours and minutes.
12. A bank has $24,726 in its vaults; $\frac{1}{2}$ is in bank-bills, $\frac{1}{3}$ is in gold, and the rest in silver. What is the value of the silver?
13. A farmer exchanges his butter for coal. His butter is worth 27 cents. How many pounds will pay for 9 tons of coal at $5.43 a ton?
14. Calling $365\frac{1}{4}$ days a year, how many days in 12 years?

120.—Improper Fractions and Mixed Numbers.

ORAL AND WRITTEN.

1. An *integer* or whole number is made up of one or more *whole* things; a fraction is made up of one or more *equal parts* of a thing. Which of these are fractions? Three; three-eighths; $\$\frac{14}{4}$; $\$625$; $\$0.50$; $\frac{2}{7}$; $\frac{22}{7}$; 22.

2. What does $\frac{4}{4}$ of a dollar equal? **3.** How much is $\frac{8}{8}$ of a foot?

4. $\frac{1}{8}$ in. $+\frac{5}{8}$ in. $+\frac{3}{8}$ in. $+\frac{7}{8}$ in. $=\frac{?}{8}$ in. or ⁓ inches.

5. Should you call $\$\frac{4}{4}$, $\frac{8}{8}$ of a foot, $\frac{16}{8}$ inches, really fractions, or fractions only in *form?*

A **proper** fraction is less in value than 1. The value of an **improper** fraction is 1 or more than 1.

6. Which of these are proper fractions? Give the value of the others. Compare together the terms of each fraction. $\frac{6}{7}$; $\frac{8}{7}$; $\$\frac{5}{4}$; $\frac{27}{12}$ ft.; $\frac{13}{15}$; $\frac{15}{7}$; $\frac{6}{3}$ yards; $\frac{3}{7}$ mile.

7. $\frac{1}{4}$ of $11=2\frac{3}{4}$; $\frac{11}{4}=$ ⁓; $\frac{1}{5}$ of $17=3\frac{2}{5}$; $\frac{17}{5}=$ ⁓.

An integer and a fraction together make a **mixed** number.

8. How many mixed numbers can you count on this page? Make 3 mixed numbers with 3, 7, and 2.

9. Change the improper fraction $\frac{15}{4}$ to a mixed number.

Explanation. 4 fourths = 1;
$\frac{15}{4}$ = as many 1's as there are 4's in 15, or $3\frac{3}{4}$.

10. Change $\frac{138}{5}$ to a mixed number.

Work. 5 fifths)138 fifths
$27\frac{3}{5}$

11. Change the mixed number $3\frac{3}{4}$ to an improper fraction.

$1 = \frac{4}{4}$;
$3 = 3 \times \frac{4}{4}$ or $\frac{12}{4}$;
$3\frac{3}{4} = \frac{12}{4} + \frac{3}{4}$ or $\frac{15}{4}$.

12. Change $27\frac{3}{5}$ to fifths.

Work. 27
$1 = \underline{\ \ 5}$ fifths
$\frac{135}{5} + \frac{3}{5} = \frac{138}{5}$

Change to mixed numbers:

13. $\frac{23}{5}$
14. $\frac{30}{7}$
15. $\frac{63}{8}$
16. $\frac{43}{9}$
17. $\frac{43}{6}$
18. $\frac{79}{8}$
19. $\frac{107}{12}$
20. $\frac{631}{10}$
21. $\frac{347}{13}$
22. $\frac{98}{17}$
23. $\frac{123}{14}$
24. $\frac{629}{28}$

Change to improper fractions:

25. $4\frac{3}{4}$
26. $5\frac{2}{3}$
27. $7\frac{1}{6}$
28. $8\frac{3}{4}$
29. $2\frac{5}{6}$
30. $7\frac{3}{10}$
31. $6\frac{4}{9}$
32. $5\frac{11}{12}$
33. $18\frac{7}{16}$
34. $15\frac{11}{12}$
35. $372\frac{3}{4}$
36. $627\frac{5}{8}$

121.—Dividing the Remainder in Division.

ORAL AND WRITTEN.

1. What is $\frac{1}{4}$ of 9 inches?

Explanation. $\frac{1}{4}$ of 9 inches is 2 inches, with 1 inch remaining; if we divide this inch into 4 equal parts we shall find 1 part to be $\frac{1}{4}$ of an inch; hence $\frac{1}{4}$ of 9 inches $= 2\frac{1}{4}$ inches.

What is

2. $\frac{1}{5}$ of 11 in.?

3. $\frac{1}{6}$ of 13 lb.?

4. $\frac{1}{9}$ of 73 yd?

5. $\frac{1}{4}$ of 21 hours?

6. $\frac{1}{8}$ of 97 gal.?

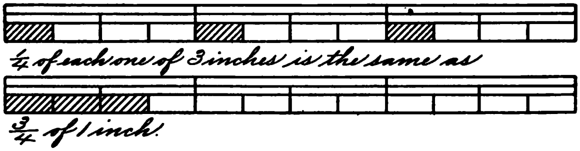
7. $\frac{1}{12}$ of 85 yr.?

8. $\frac{1}{10}$ of \$91?

9. $\frac{1}{24}$ of 25 days?

10. What is $\frac{1}{4}$ of 11 inches?

Explanation. $\frac{1}{4}$ of 11 in. = 2 in., with a remainder of 3 in. to be divided by 4; $\frac{1}{4}$ of 3 in. is the same as $\frac{3}{4}$ of 1 inch, as will be seen by the following illustration; hence $\frac{1}{4}$ of 11 in. $= 2\frac{3}{4}$ in.



11. What is $\frac{1}{8}$ of 19 inches?

12. What is $\frac{1}{10}$ of 27 lb.?

13. What is $\frac{1}{9}$ of 29 yards?

14. What is $\frac{1}{12}$ of 77 years?

15. If a railway train runs 537 miles in 25 hours, how far does it run in 1 hour?

Method.

$21\frac{12}{25}$ miles

25)537 miles

50

37

25

$\frac{1}{25}$ of 12 miles $= \frac{12}{25}$ of a mile.

16. If 32 horses eat 653 bushels of oats, what does one horse eat?

17. If 47 cars carry 1000 tons of hay, what does each car carry?

18. Find $\frac{1}{86}$ of 2573 yards.

19. Find $\frac{1}{144}$ of 7000 feet.

20. What is $\frac{1}{360}$ of 24,899 miles?

21. What is $\frac{1}{365}$ of 6429 days?

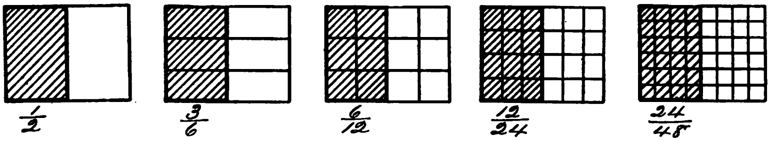
22. Find $\frac{1}{500}$ of 851 miles.

23. Find 0.001 of 3421 tons.

122.—Fractions Changed to Larger Terms.

ORAL.

1. Name the *terms* of a fraction. Which term *names* the equal parts? Which shows their *number?* Which one shows the *size* of the equal parts?
2. Which would you choose, 2 quarters or 10 nickels? $\frac{2}{4}$ of a dollar or $\frac{10}{20}$ of a dollar? Give your reason.
3. May fractions that are alike in *value* differ in *form?*



4. Name four fractions each equal to $\frac{1}{2}$? Which has the largest *terms* and which the smallest? Which has the smallest *equal parts?* Which the largest?
5. Which has the most equal parts? Which the fewest?
6. $\frac{6}{12}=\frac{?}{48}$; $\frac{12}{24}$ equal how many 6ths?
7. Which is larger, $\frac{1}{48}$ or $\frac{1}{12}$? How many times as large? Does a large denominator mean large or small equal parts?
8. Change $\frac{1}{6}$ to an equal fraction with 48 as denominator.

Explanation. $1 = \frac{48}{48}$; $\frac{1}{6} = \frac{1}{6}$ of $\frac{48}{48}$, or $\frac{8}{48}$.

Change the following fractions to larger terms:—

9. $\frac{1}{8}=\frac{?}{48}$; $\frac{1}{12}=\frac{?}{48}$; $\frac{1}{4}=\frac{?}{48}$; $\frac{1}{3}=\frac{?}{48}$; $\frac{1}{16}=\frac{?}{48}$; $\frac{1}{24}=\frac{?}{48}$.
10. Change to 12ths: $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$.
11. To 24ths: $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{6}$, $\frac{1}{8}$, $\frac{1}{12}$.
12. Change $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{6}$, $\frac{1}{9}$ to 18ths.
13. To 30ths: $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{5}$, $\frac{1}{6}$, $\frac{1}{10}$.
14. Change $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{6}$ to 36ths.
15. To 60ths: $\frac{1}{5}$, $\frac{1}{6}$, $\frac{1}{4}$, $\frac{1}{12}$, $\frac{1}{3}$, $\frac{1}{2}$.
16. Change $\frac{2}{3}$ to 12ths.

Explanation. $1 = \frac{12}{12}$; $\frac{1}{3} = \frac{4}{12}$;
$\frac{2}{3} = 2 \times \frac{4}{12}$, or $\frac{8}{12}$.

17. $\frac{1}{5}=\frac{?}{10}, \frac{?}{15}, \frac{?}{25}, \frac{?}{40}, \frac{?}{35}, \frac{?}{45}$.
18. $\frac{2}{3}=\frac{?}{24}, \frac{?}{18}, \frac{?}{30}, \frac{?}{36}, \frac{?}{15}, \frac{?}{21}$.
19. $\frac{3}{4}=\frac{?}{12}, \frac{?}{20}, \frac{?}{24}, \frac{?}{28}, \frac{?}{36}, \frac{?}{48}$.
20. Change to 24ths: $\frac{2}{3}$, $\frac{3}{4}$, $\frac{5}{8}$, $\frac{11}{12}$.
21. To 36ths: $\frac{2}{3}$, $\frac{3}{4}$, $\frac{5}{6}$, $\frac{5}{12}$, $\frac{7}{12}$, $\frac{5}{9}$.
22. $\frac{5}{8}=\frac{?}{16}, \frac{?}{24}, \frac{?}{48}, \frac{?}{32}, \frac{?}{40}, \frac{?}{64}$.
23. $\frac{11}{12}=\frac{?}{60}, \frac{?}{48}, \frac{?}{96}, \frac{?}{36}, \frac{?}{144}$.
24. $\frac{4}{5}=\frac{?}{20}, \frac{?}{80}, \frac{?}{60}, \frac{?}{25}, \frac{?}{100}$.
25. $\frac{3}{4}=\frac{?}{48}$; $\frac{5}{8}=\frac{?}{72}$; $\frac{7}{8}=\frac{?}{96}$.

123.—Fractions Changed to Smallest Terms.

ORAL.

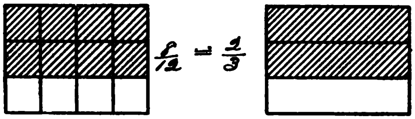
1. Draw an oblong; divide it into 4ths. Show that $\frac{2}{4}=\frac{1}{2}$.
2. In the same way show that $\frac{3}{6}=\frac{1}{2}$; $\frac{2}{8}=\frac{1}{4}$; $\frac{2}{12}=\frac{1}{6}$.
3. Which is in the *smallest* terms $\frac{6}{12}$, $\frac{3}{6}$, or $\frac{1}{2}$? How do these fractions compare in value?
4. Change these fractions to smallest terms:—

$\frac{4}{8}=\frac{1}{?}$; $\frac{5}{10}=\frac{?}{2}$; $\frac{4}{12}=$ ~~; $\frac{3}{15}=$ ~~; $\frac{4}{16}=$ ~~; $\frac{5}{20}=$ ~~; $\frac{3}{18}=$ ~~.

5. $\frac{6}{18}$, $\frac{5}{20}$, $\frac{6}{24}$, $\frac{4}{20}$, $\frac{7}{28}$, $\frac{5}{15}$, $\frac{9}{18}$, $\frac{5}{15}$, $\frac{6}{18}$, $\frac{7}{21}$, $\frac{4}{24}$, $\frac{6}{24}$, $\frac{8}{24}$, $\frac{3}{30}$, $\frac{7}{35}$, $\frac{10}{40}$.

6. Change $\frac{8}{12}$ to thirds.

Explanation. $\frac{1}{3}=\frac{4}{12}$; $\frac{4}{12}$ in $\frac{8}{12}$ 2 times; hence $\frac{8}{12}=\frac{2}{3}$.



7. Show that $\frac{9}{12}$ equals $\frac{3}{4}$, and that $\frac{12}{15}=\frac{4}{5}$.

Change the following fractions to smallest terms:—

8. $\frac{2}{12}$, $\frac{10}{12}$, $\frac{3}{18}$, $\frac{15}{18}$, $\frac{5}{20}$, $\frac{15}{20}$.
9. $\frac{6}{24}$, $\frac{18}{24}$, $\frac{4}{20}$, $\frac{16}{20}$, $\frac{5}{25}$, $\frac{20}{25}$.
10. $\frac{5}{30}$, $\frac{25}{30}$, $\frac{6}{30}$, $\frac{24}{30}$, $\frac{7}{28}$, $\frac{21}{28}$.
11. $\frac{6}{36}$, $\frac{30}{36}$, $\frac{4}{36}$, $\frac{16}{36}$, $\frac{24}{36}$, $\frac{28}{36}$, $\frac{32}{36}$.
12. $\frac{4}{48}$, $\frac{16}{48}$, $\frac{32}{48}$, $\frac{40}{48}$, $\frac{24}{48}$, $\frac{36}{48}$, $\frac{44}{48}$.
13. $\frac{6}{60}$, $\frac{18}{60}$, $\frac{42}{60}$, $\frac{5}{60}$, $\frac{35}{60}$, $\frac{55}{60}$, $\frac{9}{72}$.
14. What letters are common to the words *sing* and *rang;* that is, what letters are found in both words?
15. What figure is *common* to the numbers 1476, 2573?
16. What numbers will divide both 24 and 36?
17. What are the *common* divisors of 48 and 60?
18. What is the *greatest* number that will divide both 36 and 48?
19. What is the *greatest common divisor* of 45 and 63?
20. The dividend is 45; the divisor is 63. What is the quotient?

Explanation. $\frac{1}{63}$ of $45=\frac{45}{63}$. We have learned (page 102) that we may divide both dividend and divisor by the same number without changing the *value* of the quotient; we may therefore divide both terms of this quotient $\frac{45}{63}$ by 9, thus: $\begin{array}{r|l} 9 & 45 \\ \cline{2-2} 9 & 63 \end{array} = \frac{5}{7}$, and so change the fraction to smallest terms.

In this way change the following to smallest terms:—

21. $\frac{16}{24}$, $\frac{18}{27}$, $\frac{24}{32}$, $\frac{25}{30}$, $\frac{36}{48}$, $\frac{21}{35}$, $\frac{32}{40}$, $\frac{56}{64}$, $\frac{49}{63}$, $\frac{40}{72}$, $\frac{54}{81}$, $\frac{64}{72}$, $\frac{27}{96}$, $\frac{75}{100}$, $\frac{36}{108}$, $\frac{96}{144}$.

ORAL.

1. Change to mixed numbers: $\frac{25}{7}$, $\frac{29}{6}$, $\frac{37}{5}$, $\frac{43}{8}$, $\frac{65}{9}$, $\frac{75}{11}$.

2. Change to improper fractions: $4\frac{1}{3}$, $7\frac{2}{5}$, $8\frac{3}{4}$, $5\frac{4}{9}$, $12\frac{1}{2}$, $9\frac{7}{9}$.

3. Change to 72nds: $\frac{7}{8}$, $\frac{5}{9}$, $\frac{5}{12}$, $\frac{8}{9}$, $\frac{7}{12}$, $\frac{1}{2}$, $\frac{1}{3}$.

Change to smallest terms:—

4. $\frac{8}{12}$, $\frac{9}{12}$, $\frac{10}{12}$, $\frac{12}{16}$, $\frac{14}{16}$, $\frac{6}{16}$, $\frac{15}{18}$.

5. $\frac{14}{32}$, $\frac{20}{32}$, $\frac{30}{36}$, $\frac{18}{42}$, $\frac{36}{42}$, $\frac{33}{44}$, $\frac{20}{45}$.

6. $\frac{27}{45}$, $\frac{32}{48}$, $\frac{25}{50}$, $\frac{36}{48}$, $\frac{30}{50}$, $\frac{24}{60}$, $\frac{24}{64}$.

Compare

7. $\frac{7}{21}$ with $\frac{9}{27}$; $\frac{15}{20}$ with $\frac{27}{36}$.

8. $\frac{21}{24}$ with $\frac{28}{32}$; $\frac{14}{21}$ with $\frac{32}{48}$.

How many 8ths in

9. 4; 6; $\frac{3}{4}$; $8\frac{7}{8}$; $\frac{24}{32}$?

Change the following to 12ths:—

10. $3\frac{5}{12}$; 7; $\frac{5}{6}$; $8\frac{7}{12}$; $\frac{81}{108}$.

Change to smallest terms:—

11. $\frac{18}{72}$, $\frac{72}{80}$, $\frac{60}{84}$, $\frac{64}{96}$, $\frac{16}{72}$, $\frac{75}{100}$.

12. $\frac{25}{100}$, $\frac{50}{100}$, $\frac{70}{100}$, $\frac{60}{96}$, $\frac{10}{120}$, $\frac{108}{120}$.

Change to mixed numbers:—

13. $\frac{37}{7}$, $\frac{31}{16}$, $\frac{90}{12}$, $\frac{8}{1}$, $\frac{100}{9}$, $\frac{74}{8}$.

14. 10 is $\frac{10}{12}$ of 12, and $\frac{10}{12}=\frac{5}{6}$.
8 is what part of 10?

15. 16 is what part of 18?

16. 24 is what part of 36?

Change the following to some other form, and tell what the form is:—

17. $4\frac{8}{10}$; $\frac{75}{12}$; $\frac{21}{35}$; $\frac{2}{3}$; 16; $13\frac{1}{2}$.

18. $\frac{90}{8}$; $\frac{17}{34}$; $6\frac{9}{11}$; 12; $\frac{3}{4}$; $\frac{800}{900}$.

WRITTEN.

1. Change $73\frac{5}{6}$ to an improper fraction.

2. What mixed number = $\frac{473}{19}$?

3. Which is larger $84\frac{7}{12}$ or $\frac{1014}{12}$?

4. Change $\frac{189}{279}$ to smallest terms.

5. Change $\frac{128}{144}$ to smallest terms.

6. Change $\frac{1000}{16}$ to a mixed number with fraction in smallest terms.

7. What is $\frac{1}{32}$ of 636 feet; give quotient in simplest form.

8. Change $\frac{187}{209}$ to smallest terms.

Suggestion. When the greatest common divisor of the terms cannot be readily seen, we may divide the larger term by the smaller, and the divisor by the remainder till nothing remains. The last divisor will be the greatest common divisor of the two terms. Thus:

```
187)209(1
    187
    ───
     22)187(8
        176
        ───
         11)22(2
            22
            ──
```

$$\begin{array}{r|l} 11 & 187 \\ \hline 11 & 209 \end{array} = \frac{17}{19}$$

9. $\frac{207}{243} = \sim$

10. $\frac{500}{750} = \sim$

11. $69\frac{5}{6} = \sim$

12. $\frac{144}{1728} = \sim$

13. $96\frac{7}{9} = \sim$

14. $\frac{1000}{12} = \sim$

125.—Common Denominator.

ORAL. [Review page 87.]

1. Can you add 6 roses, 5 lilies, and 7 pinks? Can you subtract 4 potatoes from 17 turnips? Give your reason.
2. What *common name* for roses, lilies, and pinks can you think of? What *common name* have potatoes and turnips?
3. Under what *common name* might you add 7 flies, 8 bees, and 9 wasps?
4. 11 trout, + 4 robins, + 8 squirrels are 23 ⁓.
5. Find the sum of 16 gallons and 16 quarts. What change did you make before adding? Why?
6. Subtract 1 hour from 75 minutes. How did you do it?
7. Add $\frac{1}{2}$ and $\frac{1}{4}$. What change of form did you make?

From these illustrations we learn this

Principle. *Before integers or fractions can be added or subtracted they must have units of the same name and of the same size or value.*

8. $\frac{1}{2}+\frac{1}{8}=\frac{4}{8}+\frac{1}{8}=\frac{?}{8}$; $\frac{1}{3}+\frac{1}{4}=\frac{4}{12}+\frac{3}{12}=\frac{?}{12}$. What change do we make in these fractions before adding, or subtracting?

When the equal parts of two or more fractions are of the same name and size of course they will have a *common denominator*, that is, they will have denominators just alike. Changing the form of fractions so that the equal parts will be of the same name and size is called *changing fractions to a common denominator.*

Change these fractions to a common denominator, and find their sum and their difference.

9. $\frac{1}{5}$, $\frac{1}{10}$ to 10ths
10. $\frac{1}{2}$, $\frac{1}{3}$ to 6ths
11. $\frac{2}{3}$, $\frac{1}{2}$ to 6ths
12. $\frac{5}{6}$, $\frac{1}{4}$ to 12ths
13. $\frac{3}{8}$, $\frac{5}{12}$ to 24ths
14. $\frac{2}{9}$, $\frac{1}{6}$ to 18ths
15. $\frac{2}{9}$, $\frac{1}{6}$
16. $\frac{5}{6}$, $\frac{3}{10}$
17. $\frac{1}{12}$, $\frac{4}{9}$
18. $\frac{2}{9}$, $\frac{4}{5}$
19. $\frac{5}{12}$, $\frac{1}{16}$
20. $\frac{7}{12}$, $\frac{2}{5}$
21. $\frac{8}{9}$, $\frac{7}{8}$
22. $\frac{3}{10}$, $\frac{3}{25}$

126.—Addition and Subtraction of Fractions.

[Review page 90.]

We have learned that to add unlike fractions or to find their difference we must

1st. *Change the fractions so that the equal parts will have the same name and size; that is, change the fractions to a common denominator:* then

2d. *Find the sum or the difference of the numerators,* and

3d. *Change the result to its simplest form.*

ORAL.

1. Find the sum of and the difference between $\frac{2}{3}$ and $\frac{1}{2}$.

Method.

$\frac{2}{3} = \frac{4}{6}$ or $\frac{8}{12}$

$\frac{1}{2} = \frac{3}{6}$ or $\frac{6}{12}$

Their sum $= \frac{7}{6}$ or $\frac{14}{12}$ or $1\frac{1}{6}$

Their difference $= \frac{1}{6}$ or $\frac{2}{12}$.

Note. We may change halves and thirds to 6ths or 12ths, or even to larger terms, but is it not easier to use the smallest common denominator ?

Use any two adjacent fractions in either columns or lines, and find their sum or difference.

	a.	b.	c.	d.	e.	f.	g.
1.	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{8}$	$\frac{1}{3}$	$\frac{1}{5}$	$\frac{1}{6}$	$\frac{1}{12}$
2.	$\frac{1}{2}$	$\frac{2}{3}$	$\frac{3}{4}$	$\frac{5}{6}$	$\frac{7}{8}$	$\frac{5}{12}$	$\frac{1}{9}$
3.	$\frac{1}{4}$	$\frac{2}{3}$	$\frac{5}{6}$	$\frac{1}{8}$	$\frac{2}{5}$	$\frac{2}{3}$	$\frac{4}{9}$
4.	$\frac{1}{5}$	$\frac{1}{6}$	$\frac{3}{5}$	$\frac{2}{3}$	$\frac{5}{6}$	$\frac{3}{8}$	$\frac{1}{12}$
5.	$\frac{1}{6}$	$\frac{2}{5}$	$\frac{3}{4}$	$\frac{5}{8}$	$\frac{5}{12}$	$\frac{5}{9}$	$\frac{5}{18}$
6.	$\frac{1}{8}$	$\frac{5}{16}$	$\frac{9}{12}$	$\frac{1}{6}$	$\frac{5}{8}$	$\frac{4}{9}$	$\frac{11}{36}$
7.	$\frac{1}{9}$	$\frac{5}{12}$	$\frac{5}{15}$	$\frac{2}{5}$	$\frac{5}{9}$	$\frac{7}{18}$	$\frac{7}{72}$
8.	$\frac{1}{10}$	$\frac{4}{5}$	$\frac{3}{4}$	$\frac{7}{40}$	$\frac{7}{10}$	$\frac{3}{8}$	$\frac{11}{12}$
9.	$\frac{3}{8}$	$\frac{5}{16}$	$\frac{7}{32}$	$\frac{7}{8}$	$\frac{3}{16}$	$\frac{11}{32}$	$\frac{12}{16}$

WRITTEN.

Find sum and difference:

1. $\frac{19}{36}$, $\frac{69}{72}$
2. $\frac{17}{36}$, $\frac{119}{144}$
3. $\frac{7}{36}$, $\frac{47}{48}$
4. $\frac{19}{24}$, $\frac{17}{36}$
5. $\frac{13}{25}$, $\frac{71}{75}$
6. $\frac{15}{28}$, $\frac{13}{14}$
7. $\frac{43}{48}$, $\frac{103}{144}$
8. $\frac{71}{72}$, $\frac{19}{48}$
9. $\frac{11}{16}$, $\frac{11}{18}$
10. $\frac{29}{40}$, $\frac{111}{200}$

11. Find the sum of the mixed numbers $24\frac{4}{9}$ and $17\frac{1}{6}$.

Method.

$24\frac{4}{9} = 24\frac{10}{18}$

$17\frac{1}{6} = \underline{17\frac{3}{18}}$

Sum $= 41\frac{13}{18}$

Difference $= 7\frac{7}{18}$

Find sum and difference:

12. $27\frac{4}{5}$, $8\frac{3}{10}$
13. $16\frac{11}{12}$, $7\frac{5}{24}$
14. $81\frac{3}{4}$, $19\frac{2}{3}$
15. $26\frac{5}{6}$, $14\frac{3}{8}$
16. $21\frac{15}{16}$, $18\frac{1}{2}$
17. $91\frac{4}{9}$, $62\frac{1}{8}$
18. $83\frac{7}{8}$, $39\frac{5}{6}$
19. $114\frac{4}{5}$, $72\frac{1}{9}$
20. Add $\frac{7}{8}$, $\frac{5}{6}$, and $\frac{11}{12}$.
21. Add $4\frac{1}{2}$, $6\frac{1}{3}$, $4\frac{2}{9}$.
22. Add $19\frac{3}{5}$, $6\frac{3}{4}$, and $\frac{7}{10}$.
23. Add 16, $24\frac{8}{9}$, and $\frac{3}{4}$.

ORAL AND WRITTEN.

1. Subtract $4\frac{3}{8}$ from 9.

Method.

$9 = 8\frac{8}{8}$ = Minuend.

$\underline{4\frac{7}{8}}$ = Subtrahend.

Remainder $= 4\frac{1}{8}$

2. Take $29\frac{7}{9}$ from $62\frac{3}{8}$.

Method.

$62\frac{3}{8} = 62\frac{27}{72} = 61\frac{99}{72}$

$29\frac{7}{9} = 29\frac{56}{72} = \underline{29\frac{56}{72}}$

Remainder $= 32\frac{43}{72}$

Suggestions. Show that $9 = 8\frac{8}{8}$; that $5 = 4\frac{5}{5}$; $5 - 2\frac{3}{5} = \sim$. In example 2 which has the larger fraction, the minuend or the subtrahend? $62 - 1 = \sim$. $1 =$ how many 72nds? $\frac{72}{72} + \frac{27}{72} =$ how many 72nds? Show that $62\frac{27}{72} = 61\frac{99}{72}$. $\frac{56}{72}$ from $\frac{99}{72} = \sim$? 29 from $61 = \sim$?

3. Take $4\frac{2}{3}$ from 17.
4. From 100 take $37\frac{1}{2}$.
5. Subtract $16\frac{3}{4}$ from $29\frac{1}{6}$.
6. From $42\frac{7}{15}$ take $11\frac{31}{60}$.

	a.	b.	c.	d.	e.	f.	g.	h.
1.	$\frac{2}{3}$	$\frac{11}{12}$	$\frac{9}{16}$	$\frac{7}{36}$	$3\frac{1}{2}$	$13\frac{1}{6}$	$63\frac{7}{12}$	$81\frac{5}{24}$
2.	$\frac{3}{4}$	$\frac{7}{16}$	$\frac{11}{32}$	$\frac{21}{64}$	$4\frac{3}{8}$	$24\frac{1}{4}$	$59\frac{1}{8}$	$94\frac{3}{16}$
3.	$\frac{5}{6}$	$\frac{5}{18}$	$\frac{7}{9}$	$\frac{29}{72}$	$6\frac{17}{18}$	$37\frac{1}{12}$	$71\frac{3}{8}$	$85\frac{1}{3}$
4.	$\frac{7}{8}$	$\frac{4}{9}$	$\frac{5}{12}$	$\frac{65}{144}$	$4\frac{5}{24}$	$41\frac{2}{9}$	$34\frac{5}{36}$	$64\frac{1}{18}$
5.	$\frac{3}{5}$	$\frac{9}{10}$	$\frac{13}{20}$	$\frac{14}{25}$	$7\frac{4}{5}$	$30\frac{2}{15}$	$29\frac{3}{10}$	$42\frac{1}{4}$

Using the numbers in the columns, find sums and differences as below. Each direction gives five examples.

1– 5. $a + \frac{1}{2}$
6–10. $b + \frac{2}{3}$
11–15. $c + \frac{3}{4}$
16–20. $d + \frac{7}{8}$
21–25. $10 - e$
26–30. $e - 2\frac{7}{8}$
31–35. $50 - f$
36–40. $100 - g$
41–45. $h - 11\frac{2}{3}$
46–50. $a + b$

51– 55. $b + c$
56– 60. $a + c$
61– 65. $c + d$
66– 70. $a + d$
71– 75. $b + d$
76– 80. $e - d$
81– 85. $e + f$
86– 90. $f - e$
91– 95. $f + g$
96–100. $g - f$

101–105. $f + h$
106–110. $g + h$
111–115. $h - g$
116–120. $h - e$
121–125. $a + b + c$
126–130. $b + c + d$
131–135. $a + c + d$
136–140. $e + f + g$
141–145. $f + g + h$
146–150. $e + g + h$

128.—Multiplication of Fractions.

The Multiplier, an Interger; the Multiplicand, a Fraction.

ORAL.

1. We put equal numbers together into one product by ⁓.

2. $16 \times \$\frac{1}{2} =$ ⁓ dollars; $20 \times \$\frac{1}{4} =$ ⁓ dollars.

3. $\frac{3}{4}+\frac{3}{4}+\frac{3}{4}+\frac{3}{4}+\frac{3}{4}+\frac{3}{4}+\frac{3}{4}$ are ⁓ times $\frac{3}{4}$. $7 \times 3 =$ ⁓.

4. $3 \times 3¢ =$ ⁓ ¢
3×3 lb. = ⁓ lb.
$3 \times \frac{3}{4} =$ ⁓ 4ths
$\frac{9}{4} =$ ⁓

5. 5×4 ft. = ⁓ ft.
5×4 parts = ⁓ parts
$5 \times \frac{4}{7} =$ ⁓ 7ths
$\frac{20}{7} =$ ⁓

6. $7 \times \frac{1}{3} =$ ⁓
$7 \times \frac{2}{3} =$ ⁓
$7 \times \frac{3}{5} =$ ⁓
$8 \times \frac{3}{5} =$ ⁓

7. $\frac{7}{8}+\frac{7}{8}+\frac{7}{8}+\frac{7}{8}+\frac{7}{8}+\frac{7}{8}+\frac{7}{8}+\frac{7}{8} =$ ⁓ $\times \frac{7}{8}$ or ⁓ 8ths, or ⁓.

8. The numerator of a fraction shows the *number* of equal parts. If we multiply the numerator, we multiply the ⁓ of parts, and so multiply the fraction.

9. $5 \times \frac{2}{3} =$ ⁓ or ⁓
10. $6 \times \frac{3}{5} =$ ⁓ or ⁓
11. $4 \times \frac{2}{7} =$ ⁓ or ⁓
12. $4 \times \frac{5}{6} =$ ⁓
13. $5 \times \frac{4}{5} =$ ⁓
14. $8 \times \frac{3}{7} =$ ⁓
15. $4 \times 4 =$ ⁓; $4 \times \frac{1}{3} =$ ⁓
16. $5 \times 3 =$ ⁓; $5 \times \frac{1}{6} =$ ⁓
17. $5 \times 7 =$ ⁓; $5 \times \frac{1}{8} =$ ⁓

Multiply the fractions in columns or lines of the table below by the number at the top or bottom of the column or at the end of a line.

	6	5	4	10	12	
2	$\frac{2}{3}$	$\frac{5}{9}$	$\frac{3}{8}$	$\frac{11}{12}$	$\frac{4}{9}$	6
3	$\frac{5}{6}$	$\frac{6}{7}$	$\frac{7}{10}$	$\frac{7}{12}$	$\frac{3}{11}$	7
4	$\frac{3}{4}$	$\frac{5}{8}$	$\frac{3}{15}$	$\frac{7}{9}$	$\frac{3}{10}$	8
5	$\frac{7}{8}$	$\frac{4}{5}$	$\frac{5}{12}$	$\frac{7}{12}$	$\frac{5}{11}$	9
	7	8	9	7	6	

18. $4\frac{1}{3}+4\frac{1}{3}+4\frac{1}{3}+4\frac{1}{3}+4\frac{1}{3} =$ 5×4 added to $5 \times \frac{1}{3}$ or $20+1\frac{2}{3}$, or $21\frac{2}{3}$.

19. $5 \times 6\frac{1}{2} =$ what?

Process.

$$5 \times \begin{cases} 6 = 30 \\ \underline{\tfrac{1}{2}} = \underline{2\tfrac{1}{2}} \end{cases}$$

$$5 \times 6\tfrac{1}{2} = 32\tfrac{1}{2} = \text{Product}$$

20. $6 \times 4\frac{1}{4}$; $3\frac{3}{5}$; $8\frac{2}{3}$; $9\frac{5}{8}$.

21. $7 \times 2\frac{7}{8}$; $5\frac{3}{4}$; $7\frac{1}{2}$; $8\frac{3}{10}$.

22. $9 \times 5\frac{4}{5}$; $8\frac{7}{8}$; $6\frac{4}{9}$; $6\frac{2}{3}$.

23. $10 \times 3\frac{1}{3}$; $6\frac{2}{3}$; $7\frac{1}{2}$; $8\frac{3}{4}$.

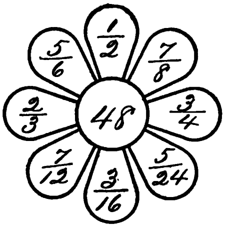
24. 12 lb. @ $\frac{3}{4}$¢ cost?
25. 10 yds. @ $\frac{3}{5}$¢?
26. 6 pt. @ $2\frac{1}{3}$¢?
27. 9 oz. @ $5\frac{1}{2}$¢?
28. 6 pins @ $12\frac{4}{5}$¢?
29. 8 books @ $7\frac{5}{6}$¢?

129.—To Find a Part of an Integer.

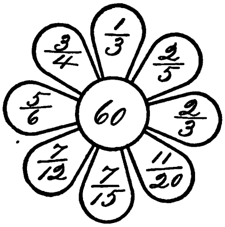
The Multiplier, a Fraction; Multiplicand, an Integer.

ORAL. [Review pp. 55, 80.]

1.



2.



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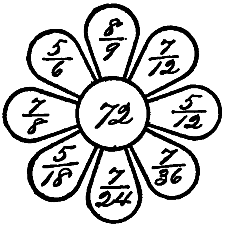


4. Of each of the following numbers find $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, $\frac{1}{6}$, $\frac{1}{7}$, $\frac{1}{8}$, $\frac{1}{9}$.
11, 13, 15, 17, 19, 23, 25, 29, 31, 37, 43, 47, 53, 59, 67.

5. Find $\frac{2}{3}$ of 17.

$\frac{1}{3}$ of 17 $= \frac{17}{3}$
$\frac{2}{3}$ of 17 $= 2 \times \frac{17}{3} = \frac{34}{3}$ or $11\frac{1}{3}$

6. Find $\frac{7}{8}$ of 21.

$\frac{1}{8}$ of 21 = ∼
$\frac{3}{8}$ of 21 = 3 × ∼ = ∼ or ∼

7. $\frac{3}{4}$ of 11 = ∼
8. $\frac{5}{6}$ of 13 = ∼
9. $\frac{7}{8}$ of 10 = ∼
10. $\frac{2}{3}$ of 17 = ∼
11. $\frac{2}{9}$ of 20 = ∼
12. $\frac{4}{5}$ of 16 = ∼
13. $\frac{3}{10}$ of 12 = ∼
14. $\frac{4}{11}$ of 5 = ∼
15. $\frac{5}{12}$ of 11 = ∼
16. $\frac{2}{7}$ of 24 = ∼
17. $\frac{3}{8}$ of 10 = ∼
18. $\frac{7}{9}$ of 12 = ∼

Find the cost of the following articles:—

19. $\frac{3}{4}$ lb. @ 10¢
20. $\frac{2}{3}$ yd. @ 16¢
21. $\frac{5}{6}$ doz. @ 25¢
22. $\frac{2}{9}$ yd. @ 30¢
23. $\frac{7}{8}$ lb. @ 20¢
24. $\frac{11}{12}$ yd. @ 30¢
25. $2\frac{1}{2}$ lb. @ 10¢
26. $3\frac{1}{3}$ yd. @ 10¢
27. $4\frac{1}{8}$ oz. @ 15¢

28. What is the difference between 6 × \$$\frac{1}{2}$ and $\frac{1}{2}$ of \$6?
29. Subtract $\frac{3}{4}$ of 12¢ from 12 × $\frac{3}{4}$¢.
30. Find the difference between $7 \times \frac{1}{8}$ of 5 and $\frac{1}{8}$ of 7×5.
31. Find $6\frac{2}{3} \times 10$.

Process.

$6\frac{2}{3} \times 10 =$ 6 × 10 added to $\frac{2}{3}$ of 10
$6 \times 10 = 60$
$\frac{2}{3}$ of $10 = 6\frac{2}{3}$
$6\frac{2}{3} \times 10 = 66\frac{2}{3}$

Find

32. $5\frac{1}{2} \times 7$
33. $3\frac{1}{5} \times 8$
34. $6\frac{2}{5} \times 7$
35. $2\frac{3}{4} \times 11$
36. $8\frac{1}{6} \times 10$
37. $3\frac{5}{6} \times 20$
38. $3\frac{1}{3} \times 20$
39. $4\frac{7}{8} \times 6$

130.—To Find the Product of an Integer and a Fractional Number.

WRITTEN.

1. What is $\frac{3}{4}$ of 48?

(a) $\frac{3}{4}$ of $48 = \frac{3 \times 48}{4} = \frac{144}{4}$ or 36

(b) $\frac{3}{\cancel{4}}$ of $\overset{12}{\cancel{48}} = 36$

Remark. We may multiply the integer by the numerator, and then divide by the denominator as in method (a).

Or, we may divide the integer by the denominator first and then multiply by the numerator as in method (b). Which is the shorter method?

3. $\frac{7}{8}$ of 96? **7.** $\frac{2}{3}$ of 423?
4. $\frac{4}{5}$ of 75? **8.** $\frac{9}{10}$ of 750?
5. $\frac{4}{9}$ of 189? **9.** $\frac{2}{7}$ of 644?
6. $\frac{5}{6}$ of 144? **10.** $\frac{7}{20}$ of 400?

19. What is $2 \times 2\frac{3}{4}$ lb.?

1st Step. 2×2 lb. $= 4$ lb.
2d Step. $\cancel{2} \times \frac{3}{\underset{2}{\cancel{4}}}$ lb. $= \underline{1\frac{1}{2}}$ lb.
3d Step. Their sum $= 5\frac{1}{2}$ lb.

* Find the value of

21. 8 books @ \$$2\frac{1}{3}$ each
22. 12 pounds @ $6\frac{1}{5}$¢
23. 9 gal. @ \$$0.12\frac{1}{2}$
24. 7 chairs @ \$$1\frac{3}{8}$
25. 15 yards @ \$$2\frac{1}{8}$
26. 10 dozen @ \$$0.16\frac{2}{3}$
27. 5 ounces @ \$$0.33\frac{1}{3}$
28. 14 cans @ \$$0.07\frac{3}{5}$

2. What is $5 \times \frac{19}{20}$?

(a) $5 \times \frac{19}{20} = \frac{95}{20} = \frac{19}{4} = 4\frac{3}{4}$

(b) $\cancel{5} \times \frac{19}{\underset{4}{\cancel{20}}} = \frac{19}{4} = 4\frac{3}{4}$

Remark. In method (a) we multiply the numerator by the integer, and then change the result, $\frac{95}{20}$, to smallest terms, $\frac{19}{4}$, by dividing both terms by 5.

In method (b) we divide by 5 *before* multiplying. Which method is better?

11. $6 \times \frac{7}{18}$? **15.** $12 \times \frac{71}{144}$?
12. $5 \times \frac{13}{45}$? **16.** $20 \times \frac{81}{100}$?
13. $8 \times \frac{17}{64}$? **17.** $16 \times \frac{4}{16}$?
14. $16 \times \frac{13}{80}$? **18.** $18 \times \frac{7}{9}$?

20. What is $2\frac{5}{8} \times 3$ bu.?

1st Step. 2×3 bu. $=$ 6 bu.
2d Step. $\frac{5}{8}$ of 3 bu. $= \frac{15}{8}$ or $\underline{1\frac{7}{8}}$ bu.
3d Step. Their sum $=$ $7\frac{7}{8}$ bu.

What is the value of

29. $6\frac{3}{4}$ pounds at 18¢?
30. $2\frac{2}{3}$ yards @ \$0.72?
31. $7\frac{5}{6}$ dozen @ \$1.20?
32. $2\frac{7}{8}$ pounds @ 60¢?
33. $6\frac{3}{8}$ tons @ \$12?
34. $2\frac{4}{5}$ feet @ \$0.24?
35. $9\frac{1}{2}$ gallons @ 13¢?
36. $6\frac{2}{3}$ dozen @ \$1.50?

---

* Give first the exact answer, and then the business man's answer, to the nearest cent.

131.—Products of Integers and Mixed Numbers.

WRITTEN.

1. How shall we find the product of 29 and $28\frac{3}{4}$?

Process. We may use either number as the multiplier, as follows:—

First Method.	*Second Method.*
29	$28\frac{3}{4}$
$\underline{28\frac{3}{4}}$	$\underline{29}$
$4\overline{)87} = (3 \times 29) \div 4$	$4\overline{)87} = (29 \times 3) \div 4$
$21\frac{3}{4} = \frac{3}{4}$ of 29	$21\frac{3}{4} = 29 \times \frac{3}{4}$
$232 = 8 \times 29$	$252 = 9 \times 28$
$\underline{580} = \underline{20} \times 29$	$\underline{560} = \underline{20} \times 28$
$833\frac{3}{4} = 28\frac{3}{4} \times 29$	$833\frac{3}{4} = 29 \times 28\frac{3}{4}$

Observe that one method proves the other.

Find the product of these numbers, proving your work:—

2. $16 \times 18\frac{5}{6}$
3. $17\frac{2}{3} \times 22$
4. $26\frac{7}{8} \times 84$
5. $32 \times 66\frac{2}{3}$
6. $33\frac{1}{3} \times 50$
7. $25 \times 87\frac{1}{2}$
8. $65\frac{3}{4} \times 57$
9. $18\frac{3}{4} \times 72$
10. $16\frac{1}{2} \times 87$
11. $15 \times 30\frac{1}{4}$
12. $16\frac{4}{9} \times 51$
13. $37 \times 83\frac{4}{5}$
14. $16\frac{2}{7} \times 22$
15. $72\frac{3}{10} \times 96$
16. $19\frac{5}{12} \times 81$
17. What will 17 lbs. of coffee cost at \$0.58$\frac{3}{4}$ a lb.?
18. A rectangle 24 in. long is $18\frac{7}{8}$ in. wide. How many square inches does it contain?
19. Find the cost of $18\frac{3}{5}$ tons of coal at \$5.50 a ton.
20. Find the perimeter of an equal-sided triangle, the base of which is $17\frac{7}{8}$ in.

Find the cost of the following articles:—

21. $16\frac{2}{3}$ yds. @ \$2.75
22. 64 yds. @ \$0.31$\frac{5}{6}$
23. $18\frac{5}{6}$ doz. @ 28¢
24. 42 books @ \$0.26$\frac{3}{4}$
25. $92\frac{7}{8}$ lbs. @ \$0.31
26. $16\frac{3}{5}$ tons @ \$7.25
27. From a piece of carpet 56 yds. long, $32\frac{7}{8}$ yds. were sold at 90 cts., and the remainder at 80 cts. How much was received for the whole?

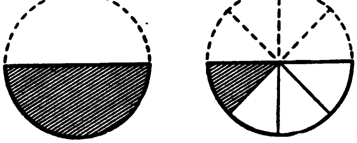
132.—To Find a Part of a Fractional Number.

ORAL.

1. What is the difference between a figure and a number?
2. What kind of number is 16 ft.? $\frac{3}{4}$ ft.? 0.25 ft.?
3. $\frac{1}{2}$ of \$16 is ⁓; $\frac{1}{2}$ of \$1 is $\frac{1}{2}$ a ⁓; $\frac{1}{2}$ of \$$\frac{1}{2}$ is $\frac{1}{4}$ of a dollar.

We may find one or more of the equal parts of several things, or of one whole thing, or even of a *part of a thing*.

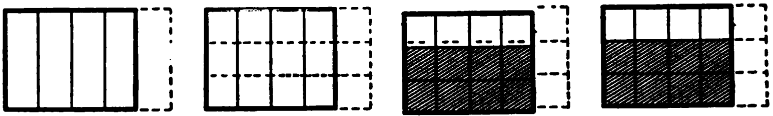
4. Divide $\frac{1}{2}$ a circle by 4; that is, find $\frac{1}{4}$ of $\frac{1}{2}$ a circle.



$\frac{1}{4}$ of $\frac{1}{2} = \frac{1}{8}$

Remember that to divide by 4 may mean to separate whatever is divided — a number, a whole thing, or a part of a thing — into 4 equal parts. $\frac{1}{2}$ a circle = $\frac{4}{8}$ of a circle; $\frac{1}{4}$ of $\frac{4}{8}$ of a circle = $\frac{1}{8}$ of a circle.

5. To find $\frac{2}{3}$ of 6 things we separate 6 things into ⁓ equal parts, and then take ⁓ of those parts.
6. To find $\frac{2}{3}$ of 1 thing we separate it into ⁓ equal parts, and then take ⁓ of those parts.
7. What is it to find $\frac{2}{3}$ of $\frac{4}{5}$ of a thing?



$\frac{4}{5}$ equals $\frac{12}{15}$ $\quad$ $\frac{1}{3}$ of $\frac{4}{5} = \frac{1}{3}$ of $\frac{12}{15} = \frac{4}{15}$ $\quad$ $\frac{2}{3}$ of $\frac{4}{5} = 2 \times \frac{4}{15} = \frac{8}{15}$

8. Draw oblongs, to show what $\frac{1}{3}$ of $\frac{1}{2}$ is; to show $\frac{2}{3}$ of $\frac{1}{2}$.

9. $\frac{1}{2}$ of $\frac{1}{4}$ = ⁓
10. $\frac{1}{3}$ of $\frac{1}{4}$ = ⁓
11. $\frac{1}{4}$ of $\frac{1}{5}$ = ⁓
12. $\frac{3}{4}$ of $\frac{1}{5}$ = ⁓
13. $\frac{3}{4}$ of $\frac{3}{5}$ = ⁓
14. $\frac{1}{3}$ of $\frac{3}{4} = \frac{1}{4}$
    $\frac{2}{3}$ of $\frac{3}{4}$ = ⁓
15. $\frac{3}{5}$ of $\frac{5}{6}$ = ⁓
16. $\frac{3}{4}$ of $\frac{4}{5}$ = ⁓
17. $\frac{1}{6}$ of $\frac{7}{8}$ = ⁓
18. $\frac{3}{4} \div 4$ = ⁓
19. $\frac{2}{3} \div 5$ = ⁓
20. $\frac{1}{8}$ of $\frac{5}{6}$ = ⁓
21. $\frac{5}{12}$ of $\frac{6}{7}$ = ⁓
22. $\frac{3}{4}$ of $\frac{3}{4}$ = ⁓
23. $\frac{2}{5}$ of $\frac{5}{7}$ = ⁓
24. $\frac{3}{5}$ of $\frac{3}{4}$ = ⁓
25. $\frac{3}{4}$ of $\frac{7}{8}$ = ⁓
26. $\frac{5}{8}$ of $\frac{8}{15}$ = ⁓
27. $\frac{2}{3}$ of $\frac{7}{9}$ = ⁓
28. $\frac{8}{9}$ of $\frac{7}{8}$ = ⁓

133.—To Find Products of Fractional Numbers.

WRITTEN.

1. To find $\frac{4}{5}$ of a number is to divide the number into ~~ equal parts, and then to take ~~ of those parts.
2. What is it to find $\frac{3}{7}$ of $21? To find $\frac{2}{3}$ of $\frac{5}{8}$ of a pound?
3. How may we multiply $\frac{2}{3}$ by $\frac{4}{5}$, or find $\frac{2}{3}$ of $\frac{4}{5}$?

Process. *One* third of $\frac{4}{5} = \frac{1}{3} \times \frac{4}{5} = \frac{4}{15}$; *two* thirds of $\frac{4}{5} = 2 \times \frac{4}{15} = \frac{8}{15}$, *Ans.*

Observe that the result, $\frac{8}{15} = \frac{2 \times 4}{3 \times 5}$, or *the product of the numerators divided by the product of the denominators.*

4. $\frac{3}{4}$ of $\frac{5}{7} = ?$ 5. $\frac{4}{5} \times \frac{7}{9} = ?$ 6. $\frac{6}{7} \times \frac{3}{5} = ?$ 7. $\frac{5}{12}$ of $\frac{7}{10} = ?$

8. Find $\frac{4}{5}$ of $\frac{13}{16}$, or the product of $\frac{4}{5}$ and $\frac{13}{16}$.

First method.

$\frac{4}{5}$ of $\frac{13}{16} = \frac{4}{5} \times \frac{13}{16} = \frac{52}{80} = \frac{13}{20}$

Second method.

$$\frac{\cancel{4}}{5} \times \frac{13}{\underset{4}{\cancel{16}}} = \frac{13}{20}$$

Observe that in the first method we change the product, $\frac{52}{80}$, to smallest terms by dividing both terms by 4 *after* multiplying. In the second method we shorten the work by dividing both terms by 4 *before* multiplying. This process of shortening the work by dividing numerators and denominators by the same number is called **Cancellation.** [Principle, p. 102.]

9. $\frac{4}{7}$ of $\frac{7}{16}$
10. $\frac{2}{3}$ of $\frac{18}{20}$
11. $\frac{3}{4} \times \frac{7}{9}$
12. $\frac{5}{10}$ of $\frac{20}{45}$
13. $\frac{5}{8}$ of $\frac{3}{10}$
14. $\frac{5}{6}$ of $\frac{2}{3}$
15. $\frac{1}{3} \times \frac{4}{5}$
16. $\frac{3}{4} \times \frac{3}{4}$
17. $\frac{7}{8} \times \frac{4}{21}$
18. $\frac{2}{5} \times \frac{5}{6} \times \frac{1}{2}$
19. $\frac{1}{4} \times \frac{4}{5} \times \frac{3}{7}$
20. $\frac{6}{7} \times \frac{5}{6} \times \frac{7}{8}$

21. (*a*) What is $\frac{3}{4}$ of $3\frac{1}{3}$? (*b*) $2\frac{1}{4} \times 3\frac{1}{2} =$ what?

Method. (*a*) $\frac{3}{4}$ of $3\frac{1}{3} = \frac{\cancel{3}}{\underset{2}{\cancel{4}}}$ of $\frac{\overset{5}{\cancel{10}}}{\cancel{3}} = \frac{5}{2} = 2\frac{1}{2}$ (*b*) $2\frac{1}{4} \times 3\frac{1}{2} = \frac{9}{4} \times \frac{7}{2} = \frac{63}{8} = 7\frac{7}{8}$

Remark. In multiplication, *mixed numbers may be changed to improper fractions.*

22. $\frac{2}{3} \times 1\frac{1}{2}$
23. $\frac{4}{5}$ of $7\frac{1}{2}$
24. $\frac{7}{8}$ of $5\frac{1}{3}$
25. $6\frac{1}{4} \times 3\frac{3}{5}$
26. $6\frac{7}{8} \times 9\frac{3}{5}$
27. $15\frac{2}{5} \times 5\frac{7}{11}$
28. $6\frac{4}{5} \times \frac{15}{16}$
29. $8\frac{2}{5} \times 7\frac{1}{7}$
30. $5\frac{1}{2} \times 5\frac{1}{2}$
31. $\frac{3}{4}$ of $2 \times 5\frac{1}{2}$
32. $16\frac{1}{2} \times 5\frac{3}{11}$
33. $\frac{7}{8}$ of $9\frac{3}{5}$

134.—Review: Fractions.

ORAL.

1. $\frac{2}{3}$ of a foot $+\frac{3}{4}$ of a foot are how many inches?
2. $7\frac{1}{2}$ lb. of sugar are in 2 packages; one weighs $2\frac{1}{8}$ lb. What does the other weigh?
3. Show that 16 is $\frac{2}{3}$ of 24; 30 is what part of 36?

What shall I pay for

4. $2\frac{3}{4}$ lb. rice @ 8¢? 5. 6 yd. cotton @ $10\frac{2}{3}$¢?
$1\frac{1}{4}$ lb. butter @ 20¢? 5 doz. buttons @ $12\frac{1}{2}$¢?
6. $\frac{7}{8}$ of my money is in half-dollars, and the remaining $2 in dimes. How much money have I?
7. A man who is half-way home has $4\frac{3}{5}$ miles to travel. How far away from home has he been?
8. Mary had $\frac{18}{20}$ of her words right, and Florence had $\frac{1}{5}$ of hers wrong. Which missed the more?
9. Charles spent $\$\frac{3}{4}$ for a dictionary. How much of his $\$4\frac{2}{5}$ was left?
10. Add $\frac{1}{2}+\frac{1}{3}+\frac{1}{4}+\frac{1}{6}$. 11. $10-\frac{2}{3}-\frac{2}{3}-\frac{2}{3}-\frac{2}{3}=\sim$
12. After selling $\frac{5}{6}$ of his papers a newsboy had 12 left. How many did he sell?
13. $11\frac{2}{5}$ from $17\frac{7}{10}=\sim$ 16. How many 27ths in $\frac{5}{9}$?
14. $\frac{3}{4}+\frac{7}{8}+\frac{1}{4}+\frac{3}{8}=\sim$ 17. $6\times4\frac{3}{5}=\sim$
15. How many cents in $\$\frac{1}{8}$? 18. Find $\frac{7}{12}$ of 18.
19. What cost 4 cords of wood at $\$7\frac{3}{4}$ per cord?
20. If 3 doz. eggs are sold for 60 cents, what shall I pay for $2\frac{3}{4}$ dozen?
21. How many quarts in 16 jars holding $\frac{3}{4}$ of a pint each?
22. Out of $1\frac{7}{8}$ bushels take 5 pecks.
23. Draw an oblong $2\frac{1}{2}$ in. long and $1\frac{1}{4}$ in. wide, and find its perimeter.
24. If one box holds $2\frac{3}{4}$ cu. in., what will 6 boxes hold?
25. The minuend is $16\frac{5}{6}$; the subtrahend $6\frac{3}{4}$; the remainder?
26. Take the sum of $1\frac{7}{8}$ and $2\frac{1}{3}$ from 16.

WRITTEN.

1. What will a gross of lead pencils cost at the rate of 2 for 5 cents?

2. At $\frac{3}{4}$ of a cent a square foot, what will it cost to paint a blackboard 20 ft. long and $4\frac{1}{2}$ ft. wide?

3. At $\$\frac{2}{3}$ for a cubic foot, what will a block of marble 6 ft. long, 3 ft. wide, and 2 ft. thick cost?

Give the amount of my bill if I buy

4.	$7\frac{3}{8}$ lb. sirloin	@ 18¢	**5.**	$3\frac{2}{3}$	yd. silk	@ $\$0.62\frac{1}{2}$
	$\frac{3}{4}$ lb. tea	@ 75¢		$\frac{3}{4}$	yd. fringe	@ $\$2\frac{1}{4}$
	6 lb. coffee	@ $28\frac{3}{4}$¢		$2\frac{7}{12}$	doz. buttons	@ $\$0.20$

6. My horse cost me $\$120$; $\frac{4}{5}$ of the cost of my horse is $\frac{1}{2}$ of the cost of my carriage. What is the cost of the latter?

7. What will $26\frac{5}{8}$ pounds of tea cost at $\$0.75$ a pound?

8. When you square $5\frac{1}{2}$, — that is, multiply it by itself, — what do you get?

9. A square rod is a square one rod, or $16\frac{1}{2}$ ft., long. How many square feet does it contain?

10. How many yards in $16\frac{1}{2}$ ft.? In $82\frac{1}{2}$ ft.?

11. A young man pays $\$3.50$ a week for board. What must he pay for the month of March?

12. Add $\frac{2}{3}$ of $\$100$ to $\frac{5}{6}$ of $\$200$.

13. Add $\frac{3}{8}$ of a day to $\frac{11}{12}$ of 3 hours.

14. After $\frac{19}{61}$ of a leap year have gone, how many days remain?

15. A checker-board contains 64 squares each $\frac{7}{8}$ of an inch long. What is the area of the board?

16. If you erase $\frac{7}{20}$ of a line $2\frac{1}{2}$ ft. long, what will be the length of the remainder?

17. If silver is worth $\$0.70$ an ounce, what is a ton of silver worth?

18. $204\frac{7}{16} - 93\frac{11}{12}$

19. $8\frac{8}{15} \times 2\frac{13}{16}$

20. $1\frac{69}{75} \div 4\frac{4}{5}$

21. $\frac{7}{8}$ of $\frac{16}{21} + \frac{5}{12}$ of $\frac{18}{25}$

136.—Division with Fractional Numbers.

ORAL.

1. How many fourths in 1? $1 \div \frac{1}{4} =$ 〰. $\frac{1}{3}$ in 1 〰 times.
2. $\frac{1}{5}$ in $\frac{1}{5}$ 〰; $\frac{1}{5}$ in $\frac{2}{5}$ 〰; $\frac{3}{5} \div \frac{1}{5} =$ 〰; $4 \times \frac{1}{5} =$ 〰; $\frac{5}{5} \div \frac{1}{5} =$ 〰.
3. $2 =$ 〰 fourths; $\frac{1}{4}$ in $\frac{8}{4}$ 〰 times; $2 \div \frac{1}{4} =$ 〰.
4. How many times is $\frac{1}{6}$ contained in $\frac{6}{6}$? In 1? In 2? In 3?
5. How many times is $\frac{3}{4}$ contained in 6?

1st Step. Change 6 to 4ths; $1 = \frac{4}{4}$; $6 = 6 \times \frac{4}{4}$, or $\frac{24}{4}$.
2d Step. Divide $\frac{24}{4}$ by $\frac{3}{4}$, or 24 by 3; 3 in 24 8 times.

How many times — What is the quotient of

6. $\frac{2}{3}$ in 5? **8.** $\frac{5}{6}$ in 3? **10.** $4 \div \frac{5}{6}$? **12.** $6 \div \frac{2}{5}$? **14.** $12 \div \frac{5}{8}$?
7. $\frac{3}{5}$ in 4? **9.** $\frac{3}{4}$ in 9? **11.** $5 \div \frac{6}{7}$? **13.** $7 \div \frac{3}{7}$? **15.** $10 \div \frac{3}{8}$?

16. How many times is $\frac{5}{6}$ contained in $4\frac{5}{6}$?

Process. $4\frac{5}{6} = \frac{29}{6}$; $\frac{5}{6}$ in $\frac{29}{6}$, or 5 in 29, $5\frac{4}{5}$ times.

How many times — What is the quotient of

17. $\frac{2}{3}$ in $3\frac{1}{3}$? **19.** $\frac{5}{8}$ in $2\frac{1}{8}$? **21.** $3\frac{1}{4} \div \frac{3}{4}$? **23.** $4\frac{1}{6} \div \frac{5}{6}$? **25.** $6\frac{2}{3} \div \frac{2}{3}$?
18. $\frac{3}{4}$ in $5\frac{1}{4}$? **20.** $\frac{2}{5}$ in $7\frac{1}{5}$? **22.** $6\frac{1}{9} \div \frac{5}{9}$? **24.** $5\frac{2}{7} \div \frac{3}{7}$? **26.** $8\frac{1}{5} \div \frac{4}{5}$?

27. How many times is $3\frac{1}{3}$ contained in $7\frac{2}{3}$?

Process. $7\frac{2}{3} = \frac{23}{3}$; $3\frac{1}{3} = \frac{10}{3}$; $\frac{10}{3}$ in $\frac{23}{3}$, or 10 in 23, $2\frac{3}{10}$ times.

How many times is

28. $3\frac{1}{2}$ in $7\frac{1}{2}$? **30.** $3\frac{1}{4}$ in $6\frac{2}{4}$? **32.** $5\frac{1}{2}$ in $9\frac{1}{2}$? **34.** $5\frac{1}{3}$ in $6\frac{2}{3}$?
29. $2\frac{1}{3}$ in $5\frac{2}{3}$? **31.** $2\frac{1}{5}$ in $7\frac{4}{5}$? **33.** $8\frac{3}{4}$ in $8\frac{3}{4}$? **35.** $6\frac{2}{3}$ in $12\frac{2}{3}$?

36. How many times is $\frac{2}{3}$ contained in $\frac{3}{4}$?

Process. $\frac{3}{4} = \frac{9}{12}$; $\frac{2}{3} = \frac{8}{12}$; $\frac{8}{12}$ in $\frac{9}{12}$, or 8 in 9, $1\frac{1}{8}$ times.

How many times

37. $\frac{2}{3}$ in $\frac{5}{6}$? **39.** $\frac{1}{6}$ in $\frac{1}{4}$? **41.** $\frac{3}{4}$ in $\frac{7}{8}$? **43.** $\frac{2}{9}$ in $\frac{5}{6}$?
38. $\frac{3}{4}$ in $\frac{7}{8}$? **40.** $\frac{1}{3}$ in $\frac{3}{4}$? **42.** $\frac{1}{3}$ in $\frac{2}{5}$? **44.** $\frac{2}{5}$ in $\frac{11}{20}$?

In division of fractional numbers we

1st. *Change dividend and divisor to a common denominator.*

2nd. *Divide the numerator of the dividend by that of the divisor, and simplify the result when needful.*

WRITTEN.

I. *The Dividend Fractional.*

1. What is $\frac{1}{8}$ of $765\frac{1}{3}$?

Work.

$$\begin{array}{r} 8\overline{)786\frac{1}{3}} \\ 98\frac{7}{24}\text{, } \textit{Ans.} \end{array}$$

$\frac{1}{8}$ of $2\frac{1}{3} = \frac{1}{8}$ of $\frac{7}{3} = \frac{7}{24}$.

Explanation. $\frac{1}{8}$ of $786\frac{1}{3} = 98$, and $2\frac{1}{3}$ remaining; $\frac{1}{8}$ of $2\frac{1}{3} = \frac{7}{24}$.

Find the value of

2. $562\frac{1}{2} \div 7$
3. $381\frac{2}{3} \div 5$
4. $429\frac{3}{8} \div 6$
5. $682\frac{1}{5} \div 9$
6. $349\frac{1}{6} \div 8$
7. $294\frac{1}{3} \div 12$

8. Divide $372\frac{2}{3}$ by 15.

Work.

$$\begin{array}{r} 15)372\frac{2}{3} \\ 3\quad\quad 3 \\ \hline 45)1118(24\frac{38}{45} \\ 90 \\ \hline 218 \\ 180 \\ \hline \end{array}$$

$\frac{1}{45}$ of $38 = \frac{38}{45}$.

Observe that we first change both dividend and divisor to thirds.

9. $297\frac{3}{4} \div 16$
10. $346\frac{2}{5} \div 21$
11. $849\frac{5}{6} \div 24$
12. $764\frac{1}{2} \div 19$
13. $847\frac{3}{8} \div 30$
14. $946\frac{7}{8} \div 43$

15. If 63 sofas cost $\$925\frac{7}{8}$, what will one cost?

16. When a train runs $873\frac{5}{12}$ miles in 25 hours, how far does it run in one hour?

17. What is $\frac{1}{4}$ of $7864\frac{7}{20}$ tons?

II. *The Divisor Fractional.*

18. How many times is $16\frac{2}{3}$ contained in 565?

Work.

$$\begin{array}{r} 16\frac{2}{3})565 \\ 3\quad\quad 3 \\ \hline 50)1695(33\frac{9}{10} \\ 150 \\ \hline 195 \\ 150 \\ \hline \end{array}$$

$\frac{1}{50}$ of $45 = \frac{45}{50}$, or $\frac{9}{10}$.

Observe that we first change both dividend and divisor to thirds.

Divide

19. 275 by $33\frac{1}{3}$
20. 181 by $15\frac{3}{4}$
21. 625 by $17\frac{3}{5}$
22. 291 by $27\frac{7}{8}$
23. 846 by $94\frac{1}{6}$
24. 933 by $72\frac{1}{9}$

25. $16\frac{1}{2}$ ft. = 1 rd. How many rods and feet are there in 800 feet?

Caution. The remainder is always like the dividend; when one is half-feet, the other is half-feet.

26. Change 975 ft. to rods and feet.

27. At $\$0.66\frac{2}{3}$ a pound, how many pounds can you buy for \$825?

28. There are $272\frac{1}{4}$ square feet in one square rod. How many square rods and square feet in 5000 square feet?

29. How many times is $216\frac{2}{5}$ contained in 498?

138.—Division with Fractional Numbers.

WRITTEN.

III. *Both Dividend and Divisor Fractional.*

1. How many times is $\frac{4}{5}$ contained in $\frac{8}{9}$?

1st. $\frac{4}{5}$ in $\frac{8}{9} = \frac{36}{45}$ in $\frac{40}{45} = \frac{40}{36} = \frac{10}{9} = 1\frac{1}{9}$. *2nd.* $\frac{8}{9} \div \frac{4}{5} = \frac{\overset{2}{\cancel{8}}}{9} \times \frac{5}{\cancel{4}} = \frac{10}{9} = 1\frac{1}{9}$.

Remark. In the second method we *invert the divisor and proceed as in multiplication*, shortening the process by cancellation. Mixed numbers may be changed to improper fractions.

2. $\frac{6}{7} \div \frac{2}{3}$
3. $\frac{11}{15} \div \frac{3}{5}$
4. $\frac{17}{24} \div \frac{5}{8}$
5. $\frac{16}{35} \div \frac{2}{5}$
6. $\frac{18}{25} \div \frac{2}{3}$
7. $\frac{17}{21} \div \frac{3}{17}$
8. $\frac{32}{35} \div \frac{8}{9}$
9. $\frac{40}{63} \div \frac{10}{21}$
10. $\frac{27}{65} \div \frac{4}{13}$
11. $\frac{55}{72} \div \frac{5}{24}$
12. $3\frac{1}{2} \div 2\frac{1}{3}$
13. $6\frac{6}{15} \div 2\frac{2}{5}$
14. $4\frac{1}{6} \div 2\frac{1}{5}$
15. $9\frac{7}{8} \div 1\frac{1}{3}$
16. $33 \div 6\frac{1}{4}$
17. $66\frac{2}{3} \div 16\frac{2}{3}$
18. $87\frac{1}{2} \div 12\frac{1}{2}$
19. $62\frac{1}{2} \div 37\frac{1}{2}$
20. $30\frac{1}{4} \div 5\frac{1}{2}$
21. $272\frac{1}{4} \div 16\frac{1}{2}$

Numbers Compared.

1. 6 is $\frac{1}{2}$ of ⁓
8 is ⁓ of 24
2. 5 is ⁓ of 15
⁓ is $\frac{1}{4}$ of 24
3. What part of 16 is 8?
What part of 36 is 9?
4. 2 is what part of 4?
5. 3 is one ⁓ of 9, and $\frac{1}{4}$ of ⁓
6. What part of 3 is found in 2? $2 \div 3 = \frac{1}{3}$ of 2, or $\frac{2}{3}$.
7. What is $\frac{3}{5}$ of 5?
8. 3 is what part of 5? Of 8?
9. What kind of fraction is the quotient when the divisor is larger than the dividend?
10. Compare 5 and 10. 10 is ⁓ times 5, or 5 is one ⁓ of 10.

In the same way compare

11. 5 and 15
12. 16 and 4
13. 24 and 6
14. 9 and 27
15. 28 and 7
16. 63 and 7
17. 81 and 9
18. 12 and 60

19. Compare 3 and 8. 8 is $2\frac{2}{3}$ times ⁓, or 3 is $\frac{3}{8}$ of ⁓.
20. Compare 10 and 12. 12 is $1\frac{1}{5}$ times ⁓, or 10 is ’ of 12.

In the same way compare

21. 12 and 15
22. 16 and 18
23. 12 and 20
24. 25 and 15
25. 30 and 16
26. 28 and 35
27. 36 and 48
28. 60 and 72

WRITTEN.

1. Into how many pieces $\frac{3}{4}$ of a yard long can 24 yards of ribbon be cut?
2. How many times can I fill a pail holding $1\frac{1}{5}$ gallons from a tank containing $14\frac{2}{5}$ gallons?
3. I have \$$12\frac{1}{2}$, \$$2\frac{1}{2}$ of which is in silver. What part of my money is in silver?

How many times is

4. $3\frac{4}{5}$ contained in 42?
5. $2\frac{7}{8}$ contained in 23?

What part of

6. $4\frac{1}{12}$ lb. is $3\frac{1}{2}$ lb.?
7. 16 □-in. is $4\frac{1}{3}$ □-in.?

8. What part of a foot-rule remains after $2\frac{1}{2}$ inches have been cut off?
9. How many pounds at $\frac{2}{3}$ of a cent each can you buy for 25 cents? How many eggs?
10. What part of 100 is $12\frac{1}{2}$? $37\frac{1}{2}$? $62\frac{1}{2}$? $87\frac{1}{2}$?
11. Compare $3\frac{1}{3}$ and $33\frac{1}{3}$.
12. Compare $6\frac{2}{3}$ and $66\frac{2}{3}$.
13. How many breadths of carpet $\frac{2}{3}$ of a yard in width will be needed for a room 18 ft. wide?
14. Compare the width and length of a blackboard measuring $3\frac{3}{4}$ ft. by 20 ft.
15. What part of a dollar is $31\frac{1}{4}$¢?
16. What is $\frac{5}{6}$ of $12\frac{3}{4}$ hours?
17. Divide the product of $3\frac{7}{8}$ and $4\frac{2}{5}$ by $2\frac{1}{5}$.
18. How many times is $\frac{7}{8}$ of $21\frac{3}{4}$ contained in $\frac{1}{2}$ of $43\frac{1}{2}$?
19. $7 \times 3 \times \sim\sim = 84$
20. $\frac{3}{4} \times \frac{2}{3} \times \sim\sim = 16\frac{1}{2}$
21. How many bars of soap in a box weighing 200 lb. if one bar weighs $1\frac{2}{3}$ lb.?
22. Divide 612 by $37\frac{1}{2}$.
23. Divide 1728 by $272\frac{1}{4}$.
24. Divide 3187 by $30\frac{1}{4}$.
25. Divide \$927 by \$$18\frac{3}{4}$.
26. If my steps measure $2\frac{7}{8}$ feet, how many shall I take in walking around a rectangular park 175 feet long and 96 feet wide?

140.—Review: Fractions.

ORAL.

1. I spent \$5 and then had $\frac{2}{3}$ of my money left. How much had I at first?
2. Take $\frac{3}{15}$ of an ounce from $\frac{4}{5}$ of an ounce.
3. How many times is $\frac{2}{3}$ of a yard contained in 5 yards?
4. What is 7 times $2\frac{1}{5}$ hours? 5. $\frac{1}{8}$ of $2\frac{2}{3} = \sim\sim$

Find the cost of

6. $\frac{3}{4}$ lb. tea @ \$0.60 7. 5 gal. oil @ $9\frac{1}{2}$¢
$\frac{7}{8}$ lb. coffee @ 0.40 6 lb. pork @ $5\frac{1}{3}$¢

8. Multiply $2\frac{1}{2}$ by itself, or square $2\frac{1}{2}$. $(2\frac{1}{2})^2 = \sim\sim$.
9. $\frac{5}{6} + \sim\sim = \frac{7}{8}$ 10. $\frac{4}{5} - \sim\sim = \frac{5}{6}$ 11. $\frac{1}{2} + \frac{1}{3} + \frac{1}{8} = \sim\sim$
12. Change $6\frac{5}{9}$ to an improper fraction. How do you prove it?
13. What part of 25 is $8\frac{1}{3}$?
14. Compare $4\frac{1}{2}$ and 9 by division.
15. At 2 for 3 cents what will 8 oranges cost?
16. A sixth of Will's age is $2\frac{1}{2}$ years. How old is he?
17. What is the date when 3 weeks remain in August?
18. What is the perimeter of a rectangle $2\frac{1}{2}$ inches long and $\frac{1}{2}$ as wide?
19. If you draw a 5-foot square on a scale of $\frac{1}{10}$, how long will your drawing be?
20. What part of a gallon is a pint? Of a bushel is a quart?
21. Find the cost of $2\frac{3}{5}$ pounds of rice at 7 cents a pound.
22. What will 16 eggs cost at 30 cents a dozen?
23. If you divide a line $3\frac{3}{5}$ inches long into half-inches, how many half-inch divisions will there be? Give the length of the remainder.
24. What is $\frac{1}{8}$ of 100? $\frac{1}{6}$ of 100? $\frac{1}{12}$ of 100?
25. $\frac{3}{8}$ of my money taken from $\frac{1}{2}$ of it leaves \$12. How much money have I?
26. If $\frac{3}{8}$ of a yard of silk sells for \$1.20, what will $\frac{4}{5}$ of a yard cost?

141.—Review: Fractions.

WRITTEN.

1. Add $2\frac{1}{5}$, $14\frac{7}{8}$, and $36\frac{3}{10}$.
2. What remains of $26\frac{4}{15}$ bushels after taking out $12\frac{9}{10}$ bushels?
3. One rod is $16\frac{1}{2}$ ft. long. How many feet in 320 rods, or 1 mile?
4. How many rods in 6000 feet?
5. $24\frac{3}{4}$ cubic feet make 1 perch. How many perch in 4000 cubic feet of masonry?
6. What will $5\frac{1}{8}$ lb. cost at $15\frac{4}{5}$¢ a pound?
7. How long is a square rod in feet? How wide? Multiply $16\frac{1}{2}$ by itself.
8. In a square rod there are $272\frac{1}{4}$ □-feet. How many □-rods in 10,000 □-feet?
9. At 42¢ a yard, what will $17\frac{3}{4}$ yards cost?

Find the cost of the following articles:—

10. $17\frac{1}{2}$ doz. pencils @ $\$1.12\frac{1}{2}$
11. $\frac{17}{20}$ ream paper @ $3.00
    5 boxes pens @ $\$0.37\frac{1}{2}$
12. $11\frac{7}{16}$ lb. turkey @ 24¢
    $8\frac{1}{4}$ lb. chicken @ 17¢
13. $2\frac{3}{4}$ yd. silk @ $\$0.87\frac{1}{2}$
14. $4\frac{1}{2}$ doz. buttons @ $0.19
    16 ps. braid @ $\$0.11\frac{3}{4}$
15. 23 lb. soap @ $2\frac{3}{8}$¢
    9 gal. vinegar @ $12\frac{1}{2}$¢
16. At $7\frac{1}{2}$¢ a pound, how many pounds of sugar can be bought for $17.25?
17. At $12\frac{1}{2}$¢ a bottle, how many bottles of ink can be bought for $12.35, and how much money will remain?
18. At $5 a week, what is my board bill for the month of December?
19. Take the sum of $4\frac{3}{8}$ and $7\frac{5}{10}$ from their product.
20. Compare $\frac{7}{15}$ and $\frac{34}{75}$.
21. $124\frac{1}{5}-117\frac{5}{9}=$ ⁓
22. Bought $26\frac{3}{5}$ tons of coal at $5 a ton, and sold $\frac{1}{2}$ of it for $6 a ton, and the rest for $100. What did I gain?
23. What is $\frac{4}{5}$ of $\frac{7}{8}$ of $2000?

142.—Miscellaneous Exercises.

ORAL.

1. A quire of paper is 24 sheets. How many sheets in 10 quires?
2. 10 quires are $\frac{1}{2}$ a ream of paper. How many quires make a ream?
3. Your writing-book contains 24 white pages. How many leaves has it? How many sheets of paper are required to make it? What part of a quire?
4. How many writing-books will a quire of paper make? How many will a ream of paper make?
5. A gross of tacks costs 12 cents. How many tacks do you buy for a cent?
6. If the wind blows 40 miles an hour, how long will it be in going 260 miles?
7. $\frac{1}{2}$ of Robert's money is in dimes, and the rest of it in quarters. If he has $2, how many coins has he?
8. A newsboy makes $\frac{1}{2}$ of a cent on every paper. If he sells 10 papers a day, how much will he earn in 4 weeks? He does not sell Sunday papers.
9. If you should cut $2\frac{1}{4}$ inches off from a foot-rule, how long would the remainder be?

At sight give first $\frac{1}{10}$ and then $\frac{1}{100}$ of

10. $5000; $25; $137.50; $20,000; 10 × $5.60.
11. How much should you have to pay for $\frac{1}{2}$ dozen eggs at 25 cents a dozen? Why?
12. In 10 years James Frye will be 21 years and 6 months old. What is his age now? When was he born?
13. Name two unequal parts, two equal parts, two factors, and three factors of 24.
14. How long will a gross of pens last a class of 48 scholars, if they use 3 each every month?

1. Dr. James French is Mr. Samuel Rand's family physician. He trades at Mr. Rand's dry-goods store. Each man keeps an **account** or a record of the business that he does with the other man. Once in a while they "settle up" or "balance their accounts." Below is Mr. Rand's account for one month. Dr. French has sent him his bill and has received *credit* for what Mr. Rand owes him. Is the account correctly cast? Who is the debtor? What must he pay?

Minneapolis, June 1, 1895.
Dr. James French,
In Account with Samuel Rand, Dr.

May 5	For 14 yds. Print	$0.13	1	82		
	" 1 Table Cloth		3	00		
20	" 2 yds. Silk	0.75	1	50		
	" 1 Umbrella		2	50		
25	" ½ doz. Gloves	4.50	2	25		
					11	07
	Cr.					
May 31	By Bill for Medical Services				6	00
	Balance due				5	07

Make out Mr. Rand's account with Dr. French for July and for August.

2. The Doctor bought

July	2	Merchandise	$6.42
"	5	do.	7.52
"	12	do.	8.14
"	17	do.	12.79

The Doctor's bill for July was $8.50.

3. Mr. Rand sold him

Aug.	4	Merchandise	$1.79
"	13	do.	2.46
"	9	do.	3.18

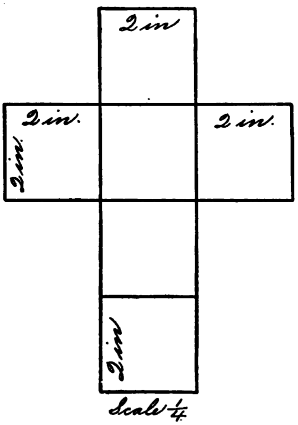
In August the Doctor made 12 calls at Mr. Rand's at $1.50 each.

144.—Measurement of Surfaces and Solids.

WRITTEN.

1. Compare a cube, a square prism, and some other rectangular solid, and tell how they are alike and how they differ.
2. Find the area of the entire surface of a 2-inch cube.

Suggestion. Cut a paper of the shape of the accompanying drawing and fold it into the form of a cube 2 inches long.



3. What is the area of the sides of a 3-inch cube?
4. How many square inches of surface on a 4-inch cube?
5. How many square feet in the whole area of a cube 1 yd. long, 3 ft. wide, and 36 in. high? What is a cubic yard?
6. What is the length of all the edges of a 4-foot cube?
7. Compare a 5-inch cube and 5 cubic inches.
8. A room 10 ft. wide and 12 ft. long will require how many feet of picture moulding?
9. What will be the area of the floor? Of the ceiling?
10. How many cubical boxes just a foot long will such a room hold if it is 9 feet high?
11. How many cubic inches in a brick 8 in. by 4 in. by 2 in.?
12. How many penwipers 3 inches square can be cut from a piece of cloth 15 inches square? Draw a diagram.
13. How many 2-inch cubes can you put into a cubical box 1 foot long?
14. I bought 2 silk handkerchiefs, one 2 feet square and the other 30 inches square. How many more square inches in the larger than in the smaller?

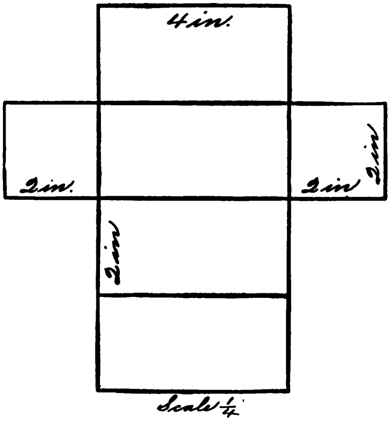
145.—Measurements.

WRITTEN.

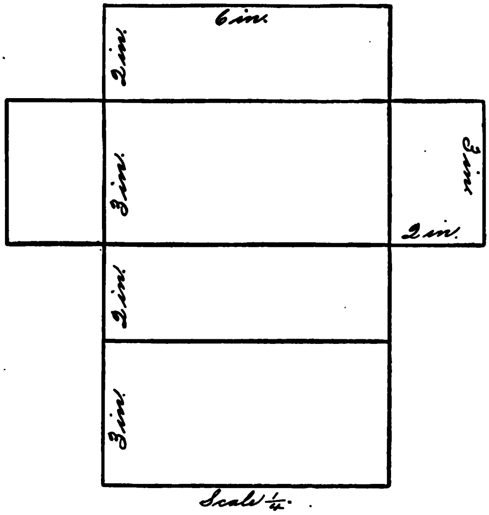
1. Find the contents of a rectangular solid 4 in. long, 2 in. wide, and 2 in. thick.

2. What is the shape of each end? What is a square prism? Find the area of the six surfaces of the square prism mentioned in the preceding example. Study the diagram.

Suggestion. Cut paper like the pattern at the right of the proper size, and fold it to make a prism.



3. Find the area of the six surfaces of a block of marble 5 ft. long and 3 ft. square at each end.



4. A box 6 in. long, 3 in. wide, and 2 in. deep contains how many square inches of surface? Study the diagram.

5. Cut paper to make such a box, and find how many inch cubes it will hold.

6. How many square inches of paper will line the inside of a box 10 in. long, 6 in. wide, and 4 in. deep?

146.—Decimal Fractions.

ORAL. [Review pp. 98–102.]

Read the following decimal fractions: —

1. 0.3 of a yr. 0.03 of a yd. 0.003 of a rod 0.27 of a \$
2. 0.7 of a yr. 0.07 of a lb. 0.007 of a ton \$0.36
3. $\frac{9}{10}$ of a mo. $\frac{18}{100}$ of a \$ $\frac{126}{1000}$ of a mile $\$\frac{42}{100}$
4. Write the fractions in Exercises **1** and **2**, using denominators.
5. Write the fractions in Exercises **3** without denominators.
6. Compare the number of ciphers in the denominator with the number of figures at the right of the point.
7. Are decimal fractions generally written with or without denominators? How may we tell the denominator?

The denominator of a decimal fraction is always 1, *with as many ciphers as there are figures at the right of the point.*

8. Why is our system of numbers called a *decimal* system?

1 tenth = $\frac{1}{10}$ = 0.1
1 hundredth = $\frac{1}{100}$ = 0.01
1 thousandth = $\frac{1}{1000}$ = 0.001
1 ten-thousandth = $\frac{1}{10000}$ = 0.0001
1 hundred-thousandth = $\frac{1}{100000}$ = 0.00001
1 millionth = $\frac{1}{1000000}$ = 0.000001

9. Which is the largest of these six fractions? The smallest?

The order and names of integral and decimal units are shown in the following

TABLE.

millions	hundred-thousands	ten-thousands	thousands	hundreds	tens	ones	*decimal point*	tenths	hundredths	thousandths	ten-thousandths	hundred-thousandths	millionths
2,	3	5	7,	6	8	3	.	3	8	6,	7	5	3

WRITTEN.

1. Read the following decimals and mixed decimals: —

0.38	0.097	0.004	2.08	27.642
0.275	6.009	9.0219	3.039	82.8764
0.3864	0.3018	0.03641	7.346	93.9231
2.0781	0.8000	3.09010	8.649	27.3642

2–6. Find the sum of each column of numbers above.

Write the following decimal numbers and find their sum: —

7. $\frac{27}{100}$; $1\frac{8}{10}$; $\frac{64}{1000}$; $9\frac{176}{1000}$; $\frac{2476}{10000}$; $\frac{6}{1000}$; $\frac{84}{10000}$; $8\frac{29}{1000}$.

8. $\frac{16}{100}$; $\frac{25}{1000}$; $7\frac{29}{100}$; $9\frac{36}{1000}$; $\frac{15}{1000}$; $\frac{247}{10000}$; $86\frac{1}{2}$; $9\frac{84}{1000}$.

Decimals changed to common fractions.

9. Change 0.75 to a common fraction.

Process. $0.75 = \frac{75}{100}$; $\begin{array}{r|l} 25 & 75 \\ 25 & 100 \end{array} = \frac{3}{4}$.

Change to common fractions:—

10. 0.80
11. 0.125
12. 0.375
13. 0.625
14. 0.875
15. 0.0625
16. 0.025
17. 0.640
18. 0.95

Remark. A common fraction with a decimal, like $0.16\frac{1}{3}$, is called a *complex decimal.*

32. Change $0.33\frac{1}{3}$ to a simple fraction.

Process.

$$0.33\tfrac{1}{3} = \frac{33\frac{1}{3}}{100};\ \frac{33\frac{1}{3} \times 3}{100 \times 3} = \frac{100}{300} = \frac{1}{3}.$$

Suggestion. First multiply both terms by the denominator 3.

Change to simple fractions: —

34. $0.16\frac{2}{3}$
35. $0.66\frac{2}{3}$
36. $0.87\frac{1}{2}$
37. $0.18\frac{3}{4}$
38. $0.31\frac{1}{4}$
39. $0.83\frac{1}{3}$

Common fractions changed to decimals.

19. Change $\frac{3}{4}$ to a decimal.

Process. $\frac{3}{4} = \frac{1}{4}$ of 3; $3 = \frac{300}{100} = 3.00$.
$\frac{1}{4}$ of $3.00 = 4\overline{)3.00}$
0.75, *Ans.*

Change to decimals: —

20. $\frac{1}{8}$
21. $\frac{3}{8}$
22. $\frac{5}{8}$
23. $\frac{7}{8}$
24. $\frac{1}{12}$
25. $\frac{1}{16}$
26. $\frac{3}{25}$
27. $\frac{7}{20}$
28. $\frac{7}{16}$
29. $\frac{3}{5}$
30. $\frac{15}{16}$
31. $\frac{17}{25}$

33. Change $\frac{5}{6}$ to a decimal.

Process. $6\overline{)5.000}$ *or* $6\overline{)5.00}$
$0.833+$ $\quad$ $0.83\frac{1}{3}$

Suggestion. We may either use + to show an undivided remainder, or give the quotient exactly as a complex decimal.

Change to decimals: —

40. $\frac{2}{3}$
41. $\frac{1}{6}$
42. $\frac{2}{7}$
43. $\frac{5}{12}$
44. $\frac{7}{12}$
45. $\frac{4}{9}$

148.—Hundredths Written as Per Cents.

ORAL.

1. Marion Page misses 5 words *in a hundred.* What *part* does she miss? We may say she misses $\frac{1}{20}$, or $\frac{5}{100}$, or 0.05, or 5 in a hundred, or 5 per cent; for these expressions all mean the same thing.
2. If $\frac{8}{100}$, or 8 per cent, of a farmer's sheep are black, how many black sheep in a flock of 100? How many of his sheep are white?
3. 10 per cent means $\frac{?}{100}$, or ⁓ in a hundred.
4. What does 6 per cent mean? 12 per cent? 25 per cent? The symbol % stands for *per cent.*
5. What is meant by 9%? 15%? 30%? 50%? 40%?
6. How many hundredths in 1? How many per cent in 1?
7. If you miss 4% of your spelling lesson, what % do you spell correctly? 100% − 4% = ⁓%.

Per cents being so many *hundredths* may generally be changed to simple fractions. Thus, 25%, or $\frac{25}{100} = \frac{1}{4}$.

Some fractions and some per cents are so often used in business that we should be able to give their value in different forms at sight. Therefore, learn this

TABLE.

$\frac{1}{2} = 50\,\%$
$\frac{1}{3} = 33\frac{1}{3}\%$
$\frac{2}{3} = 66\frac{2}{3}\%$
$\frac{1}{4} = 25\,\%$
$\frac{3}{4} = 75\,\%$
$\frac{1}{5} = 20\,\%$

$\frac{2}{5} = 40\,\%$
$\frac{3}{5} = 60\,\%$
$\frac{4}{5} = 80\,\%$
$\frac{1}{6} = 16\frac{2}{3}\%$
$\frac{5}{6} = 83\frac{1}{3}\%$
$\frac{1}{7} = 14\frac{2}{7}\%$

$\frac{1}{8} = 12\frac{1}{2}\%$
$\frac{3}{8} = 37\frac{1}{2}\%$
$\frac{5}{8} = 62\frac{1}{2}\%$
$\frac{7}{8} = 87\frac{1}{2}\%$
$\frac{1}{12} = 8\frac{1}{3}\%$
$\frac{1}{15} = 6\frac{2}{3}\%$

$\frac{1}{20} = 5\,\%$
$\frac{1}{25} = 4\,\%$
$\frac{1}{30} = 3\frac{1}{3}\%$
$\frac{1}{40} = 2\frac{1}{2}\%$
$\frac{1}{50} = 2\,\%$
$\frac{3}{50} = 6\,\%$

8. What is $62\frac{1}{2}\%$ (or $\frac{5}{8}$) of 40? Of 64? Of 100?
9. Subtract each per cent in the table from 100.
10. How many cents in each fractional part of a dollar shown in the above table?

149.—Multiplication in Decimals.

ORAL.

1. What is 0.8 of 20?

Process. 0.1 of 20 = 2;
0.8 of 20 = 8 × 2, or 16;
or, 8 × 20 = 160;
$\frac{1}{10}$ of 160 = 16.0

2. What is 5% of 200?

Process. 1%, or $\frac{1}{100}$ of 200 = 2;
5% = 5 × 2, or 10.

Remark. We find $\frac{1}{100}$ of a number by moving the point ~ places to the left [p. 101].

3. What is 0.4 of 0.6?

Process. $\frac{4}{10}$ of $\frac{6}{10}=\frac{24}{100}=0.24$.

4. What is 0.6 × 0.12?

Process. $\frac{6}{10}\times\frac{12}{100}=\frac{72}{1000}=0.072$.

Remark. There will be as many decimal places in the product as there are in both factors.

5. 0.5 of 40
6. 5% of 300
7. 0.6 of 0.8
8. 0.3 × 0.09
9. 0.7 × 0.8
10. 0.12 × 0.12
11. 3% of 900
12. 20% of 500
13. 0.25 of 600
14. 0.7 × 0.90
15. 0.6 × 2.5
16. 0.30 × 0.30

17. I had $500, but spent 20% of it. How much did I spend? What % had I left?

18. $87\frac{1}{2}$% of 40 = ~

19. $66\frac{2}{3}$% of 21 = ~

WRITTEN.

20. Find 0.7 of $18.25.

Work. $18.25
0.7
$12.775, or $12.78

21. Find 6% (0.06) of $75.86.

Work. $75.86
0.06
$4.5516, or $4.55

Suggestions. $\frac{7}{10}=\frac{1}{10}$ of 7. 6% = $\frac{1}{100}$ of 6. How many decimal places in both factors in Ex. **20**? In the product? In Ex. **21** why do you point off 4 decimal places?

22. 3.2 × 2.4
23. 0.26 × 37.5
24. 0.08 × 9.6
25. 4.5 × 90.8
26. 0.8 of 6.4
27. 0.3 × 0.273
28. 6.5 × 37.2
29. 35% of 9.6
30. 82% of 10.8
31. 37% of $86
32. $0.7\frac{1}{3}$ × 2.7
33. $0.8\frac{1}{5}$ × 0.65
34. $37\frac{1}{2}$% of 8.4
35. 0.83 × 62.7
36. 0.009 × 8.64

37. Bought a house for $5400, and gained 25% when I sold it. How much did I gain?

38. What had I left after paying out 45% of $200?

150.—Division in Decimals.

WRITTEN. [Review p. 104.]

1. \$3 ÷ \$0.05 = 300¢ ÷ 5¢ = ∼ **2.** \$4 ÷ \$0.25 = ∼

3. How many times is 0.8 contained in 0.96?

Work.

$$\begin{array}{r} 0.8\overline{)0.96} \\ 8.\overline{)9.6} \\ 1.2 \end{array}$$

Explanation. 1st Step. We make the divisor an integer by moving the point one place to the right. This multiplies the divisor by 10.

2d Step. As we have multiplied the divisor by 10, we must also multiply the dividend by 10. We do this by moving the point one place to the right.

PRINCIPLE. *Multiplying both dividend and divisor by the same number does not change the value of the quotient.*

3d Step. Divide 9.6 by 8. The point in the quotient comes directly under the point in the dividend.

4. 6.48 ÷ 0.6
5. 9.08 ÷ 0.2
6. 1.44 ÷ 0.06
7. 3.28 ÷ 0.4
8. 0.36 ÷ 0.09
9. 0.049 ÷ 0.7
10. 0.216 ÷ 0.9
11. 6.4 ÷ 0.08
12. 0.8 ÷ 0.16
13. 12.8 ÷ 1.6
14. 300. ÷ 0.06
15. 7.2 ÷ 12.
16. 14.4 ÷ 1.2
17. 144. ÷ 0.12
18. 10.8 ÷ 0.009

19. How many times is 1.44 contained in 1.728?

Work.

$$\begin{array}{r} 1.2 \\ 1.44)1.728 = 144.\overline{)172.8} \\ \underline{144} \\ 28\,8 \\ \underline{28\,8} \end{array}$$

Explanation. Here we multiply both divisor and dividend by 100 by moving each point two places to the right. The point in the quotient is directly over that in the dividend. Should there be a remainder, ciphers may be annexed to the dividend and the division extended.

20. 25.6 ÷ 1.6
21. \$32. ÷ \$0.625
22. 1.6 ÷ 0.625
23. 17.28 ÷ 1.44
24. 0.8 ÷ 1.6
25. 62.5 ÷ 0.125
26. \$3.60 ÷ \$0.16⅔
27. 1.296 ÷ 0.36
28. 7.2 ÷ 120.
29. 12.6 ÷ 0.21
30. 2.5 ÷ 0.6¼
31. 0.381 ÷ 1.9
32. \$6.75 ÷ \$0.12½
33. 8.4 ÷ 14%
34. 17.5 ÷ 25%
35. 0.25 ÷ 0.75
36. 80. ÷ 8000.
37. 72 ÷ 14.4

38. How many pounds at \$0.036 may be bought for \$3.24?

WRITTEN.

1. Change 0.875 to a common fraction.
2. What decimal is the same in value as $\frac{15}{16}$?
3. Subtract $\frac{5}{8}$ from 10.427.
4. If you buy a gun for \$13.75 and sell it so as to gain 20%, what is the selling price?
5. If 0.75 of a pound of pepper is put into a single package, how many packages will 175 pounds make?
6. Divide 0.1875 of 2.56 by 6$\frac{1}{4}$%.
7. At \$.16$\frac{2}{3}$ a yard, how many yards of ribbon may be bought for \$4.25. How many collars at \$0.16$\frac{2}{3}$ each?
8. If you should draw a circle 5 in. in diameter, its circumference would be 3.1416 times as long, or — inches.
9. A farmer builds a bin 8 ft. long 4 ft. wide and 2.5 ft. deep. How many cubic feet will it hold?
10. 0.8 of its contents in cubic feet will show how many bushels a bin will hold. How many bushels of potatoes can be put into the bin mentioned in Ex. 9?

Find the amount of the following bills:—

11. 7$\frac{1}{2}$ yds. @ \$0.62$\frac{1}{2}$
3$\frac{1}{4}$ yds. @ 0.50
2$\frac{1}{3}$ doz. @ 0.75

12. 20 lbs. @ \$0.007
60 lbs. @ $\frac{3}{4}$¢
$\frac{1}{2}$ doz. @ \$0.37$\frac{1}{2}$

13. Take the sum of 12$\frac{1}{2}$%, 37$\frac{1}{2}$%, and 6$\frac{1}{4}$% from 100%.
14. How many rods and feet in 1200 ft., one rod being 16.5 ft. in length?
15. I pay \$0.073 for the use of \$1. What shall I pay for the use of \$275?
16. In a school of 625 pupils, 40% are boys. How many girls in the school?
17. How many pencils will \$54 buy at \$0.06$\frac{1}{4}$ each?
18. Divide 1.080 − 0.096 by the subtrahend.

ORAL.

1. What is $\frac{5}{5}$ of 20? $\frac{6}{6}$ of 24? $\frac{8}{8}$ of 32? $\frac{9}{9}$ of any number?

2. $6 = \frac{1}{5}$ of $\sim$ **3.** $2\frac{1}{2} = \frac{1}{10}$ of $\sim$ **4.** $3\frac{1}{3} = \frac{1}{3}$ of $\sim$ **5.** $7 = \frac{1}{100}$ of $\sim$
$8 = \frac{1}{8}$ of $\sim$ $15 = \frac{1}{2}$ of $\sim$ $6\frac{2}{3} = \frac{1}{3}$ of $\sim$ $9 = 1\%$ of $\sim$
$9 = \frac{1}{12}$ of $\sim$ $6 = \frac{1}{9}$ of $\sim$ $16\frac{2}{3} = \frac{1}{6}$ of $\sim$ $8 = 1\%$ of $\sim$

6. If $8 = \frac{2}{3}$ of a number, $\frac{1}{3}$ of the number $= \frac{1}{2}$ of 8, or 4; $\frac{3}{3}$ of the number $= 3 \times 4$, or 12. Hence, 8 is $\frac{2}{3}$ of $\sim$.

7. If 18 years $= \frac{3}{5}$ of my age, $\frac{1}{5}$ of my age $= \frac{1}{3}$ of $\sim$ years, or $= \sim$ years; $\frac{5}{5}$ of my age $= 5 \times 6$ years, or $\sim$ years.

8. $15 = \frac{3}{7}$ of $\sim$ **11.** $\frac{4}{5}$ of $\sim = 16$ **14.** $36 = \frac{6}{7}$ of $\sim$
9. $24 = \frac{4}{5}$ of $\sim$ **12.** $\frac{3}{8}$ of $24 = \sim$ **15.** $42 = \frac{6}{7}$ of $\sim$
10. $30 = \frac{3}{10}$ of $\sim$ **13.** $\frac{2}{7}$ of $\sim = 14$ **16.** $64 = \frac{8}{9}$ of $\sim$
17. $18 = \frac{18}{24}$, or $\frac{?}{4}$ of 24 **18.** $20 = \sim$ of 36
19. $36 = \sim$ of 45 **21.** $50 = \sim$ of 60 **23.** $\frac{5}{6}$ of $\sim = 60$
20. $18 = \sim$ of 27 **22.** $\frac{5}{6}$ of $\sim = 50$ **24.** $48 = \sim$ of 60

25. If \$5 = 1% of my money, 100%, or all of it, = 100 × \$5, or \$500.

26. If \$24 = 6% of my money, 1% of it $= \frac{1}{6}$ of \$24, or \$$\sim$. 100%, or all of it, = 100 × \$$\sim$, or \$400.

How much money have I if

27. 1% = \$7? **30.** 3% = \$21? **33.** 16 = 6% of $\sim$?
28. 1% = 2.50? **31.** 4% = \$12? **34.** $12\frac{1}{2}\%$ (or $\frac{1}{8}$) of \$40 = $\sim$
29. 2% = \$10? **32.** 5% = \$20? **35.** $37\frac{1}{2}\%$ (or $\sim$) of \$48 = $\sim$

36. \$12 is 25% of my money. How much have I?

37. 4 is $\frac{1}{2}$, or 50% of 8. **39.** 6 is $\frac{1}{2}$, or $\sim$% of $\sim$
38. 9 is $\frac{1}{3}$, or $33\frac{1}{3}\%$ of $\sim$. **40.** 12 is $33\frac{1}{3}\%$ of $\sim$
41. $7 = \frac{1}{12}$ of $\sim$ **44.** $27 = \frac{3}{8}$ of $\sim$ **47.** 40% of 15 = $\sim$
42. $7 = 8\frac{1}{3}\%$ of $\sim$ **45.** $27 = 37\frac{1}{2}\%$ of $\sim$ **48.** 36 = 60% of $\sim$
43. $20 = 16\frac{2}{3}$ of $\sim$ **46.** $45 = 62\frac{1}{2}\%$ of $\sim$ **49.** 8 = $\sim$% of 12.

50. James missed 6 words out of 30. This was $\frac{1}{?}$, or $\sim$%.

51. Ellen spelled 16 words out of 20, correctly. This was $\frac{?}{20}$, or $\frac{?}{5}$, or $\sim$% of those she spelled.

ORAL.

1. 3 ft. 9 in. are how many inches?
2. 1 yd. 2 ft. 7 in. are how many inches?
3. 2 lbs. 9 oz. are how many ounces?
4. 3 bu. 6 qts. are how many quarts?
5. In 1 bu. 3 pks. how many pecks?
6. In 87 in. how many yards and inches? How many feet and inches?
7. In 60 oz. how many pounds and ounces?
8. How many minutes in 2 hr. 45 min.?
9. Add 3 ft. 4 in. and 2 ft. 8 in.
10. Add 2 ft. 7 in. and 5 ft. 11 in.
11. Take 4 yr. 6 mo. from 13 yr. 9 mo.
12. Take 1 yr. 9 mo. from 5 yr. 6 mo.

Numbers like 2 lb. 4 oz. made up of two or more numbers of the same general kind are **Compound Numbers.**

13. In $\frac{4}{9}$ of a yard how many feet and inches?
14. How many feet and inches in a rod? In $\frac{1}{2}$ a rod?
15. Find the perimeter of a square 2 ft. 4 in. long.
16. What will 27 ft. of picture cord cost at 12 cts. a yard?
17. What will 2 lb. 5 oz. of butter cost at 32 cts. a pound?
18. How many days from May 10 to June 26?
19. What part of a minute is 48 seconds?
20. How long is the day when the sun rises at 7.15 and sets at 4.20?
21. How many square feet in 4 sq. yd. 7 sq. ft.?
22. At \$$3\frac{1}{2}$ a week, what is my board bill for 3 wk. and 5 da.?
23. Add 4 hr. 20 min. 45 sec. to 3 hr. 10 min. 15 sec.
24. Multiply 3 ft. 7 in. by 10.
25. How much is $\frac{1}{3}$ of 13 ft. 9 in.?
26. The sides of a triangular field measure 13 rd. 8 ft., 12 rd. 3 ft., and 14 rd. $5\frac{1}{2}$ ft. Find its perimeter.

154.—Measurements.

WRITTEN.

1. Compare an inch with a foot; a foot with a yard; a yard with a rod.
2. Compare a □-inch with a □-foot; a □-foot with a □-yard.

Long distances are measured in *rods* and *miles*.

5½ yards or 16½ feet = 1 rod (*rd.*);
320 rods = 1 mile (*m.*).

3. How many feet in a mile? 320 × 16½ ft. = ⁓ ft.
4. How many rods in ½ a mile? In ¼ m.? In ⅛ m.? In $\frac{1}{16}$ m.?
5. What part of a mile in 160 rd.? In 32 rd.? In 64 rd.?
6. How far do you walk in rods if you walk 62½% of a mile?
7. 5280 ft. = 1 mile. How many feet in 10% of a mile? In $\frac{1}{100}$ of a mile? 5.280 ft. = what part of a mile?
8. Find the number of inches in a mile.
9. In 13½ miles how many rods? How many feet?
10. How many feet and inches in 75 rods?

Small lots of land are generally measured in *square feet.* Larger land surfaces are measured in *square rods*, in *acres*, or in *square miles.*

11. Draw a square 4⅛ in. long to represent a square rod. Divide it into oblongs ¼-in. wide. An oblong 16½ ft. long and 1 ft. wide contains ⁓ □-ft.; 16½ such oblongs contain 16½ × 16½ □-ft. or ⁓ □-ft.

272¼ square feet = 1 square rod (*sq. rd.*) or (□-*rd.*)
160 square rods = 1 acre (*A.*)
640 acres = 1 square mile (*sq. m.*)

12. A piece of land 20 rds. long and 8 rds. wide contains how many square rods? Compare it with an acre.
13. Describe a square mile. Give its length in rods.
14. A township 6 m. square contains how many square miles? How many acres?

155. — Measurement of Lumber.

WRITTEN.

1. What is a square foot? What is a cubic foot?

A **board-foot** is a square piece of board a foot long, a foot wide, and an inch thick.

2. How many such pieces of board piled together would make a foot-cube?

Boards, plank, joists, beams, and squared timber are measured in board-feet.

3. If there were no waste in sawing, how many boards 1 ft. square could be cut from a board 8 ft. long and 12 in. wide?

4. 8 in. is what part of a foot? A board **1** ft. long and 8 in. wide contains $\frac{2}{3}$ of a board-foot. A board **15** ft. long and 8 in. wide contains ∼ times $\frac{2}{3}$ bd.-ft., or 10 bd.-ft. If the board were **2** inches thick, it would contain 2 times as many board-feet, or ∼.

5. How many board-feet in a board 9 in. wide and 16 ft. long? Suppose it were 3 in. thick. What would it contain?

Note. In finding the contents of a piece of lumber we do not consider the thickness unless it is *more* than one inch.

Find the contents in board-feet of

6. A plank 10 ft. long, 6 in. wide, 2 in. thick.
7. A joist 15 ft. long, 4 in. wide, 3 in. thick, — a "3 × 4 joist."
8. A board 18 ft. long, 18 in. wide, $1\frac{1}{2}$ in. thick.
9. A 3 × 5 joist 20 ft. in length.
10. A beam 18 ft. long, 8 in. wide, 6 in. thick.

Lumber is generally sold for so much per thousand (M.) board-feet.

Find what must be paid for

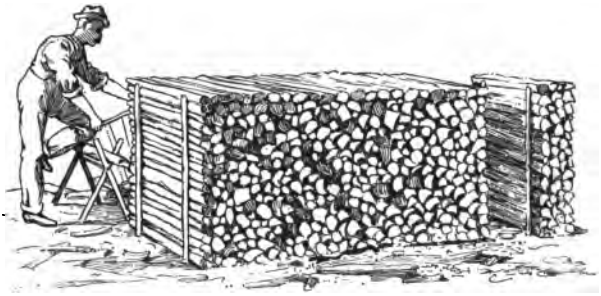
11. 3000 ft. of spruce @ $16.
12. $2\frac{1}{2}$ M. white pine @ $17.
13. 4500 ft. hard pine @ $42.
14. 800 ft. of walnut @ $60.
15. 750 ft. of whitewood @ $38.
16. 1600 ft. of cherry @ $80.

156. — Measurements.

WRITTEN.

1. Draw a square to represent a square rod. Find the length of its perimeter.
2. Divide a square rod into 4 equal squares, and find the length of the perimeter of one of them.
3. A lot of land is 150 ft. long and 60 ft. wide. How many square feet does it contain? What is it worth at $0.37½ per square foot?
4. What is a field containing 2½ A. worth at $2½ per square rod?
5. What is the difference between a 2-mile square and 2 square miles?
6. How many acres in a ½-mile square?
7. How many acres in half a square mile?
8. Give the dimensions of a cubic yard in feet and in inches.
9. How many cubic feet in a cubic yard? How many cubic inches in a cubic foot? In a cubic yard?
10. How many cakes of soap 2 in. wide and 3 in. long can you lay on the bottom of a box 1 ft. square? If the box is 9 in. deep, and each cake 1½ in. thick, how many cakes will the box hold?
11. Find the area of the entire surface of a 6-inch cube.
12. How many cubic feet of bricks in a pile 8 ft. long, 4 ft. high, and 3 ft. wide? How many bricks in the pile if 27 bricks contain 1 cu. ft.?
13. How many square feet in 1 sq. rd.? How many square rods in 1 A.? How many square feet in an acre?
14. Measure your school-room and find the number of cubic feet of air it contains.
15. How many square feet in a square yard? How many square yards in the ceiling of your school-room?
16. Find the cost of the flooring at $42.50 per M.; allow 250 bd.-ft. for waste in matching and sawing.

WRITTEN.



A CORD OF WOOD.

Fire-wood is generally cut into sticks 4 ft. long. A pile of these 4-ft. sticks, 8 ft. in length and 4 ft. high, is called a **Cord** of wood.

1. How many foot-cubes in a row 8 ft. long? How many in a layer 4 ft. wide and 8 ft. long? How many in a pile of foot-cubes 4 ft. high, 8 ft. long, and 4 ft. wide?

$4 \times 4 \times 8$ cu. ft. = **128 cu. ft. = 1 cord** (*cd.*).

2. If we should cut 1 foot off the end of a cord of wood, it would be a *cord foot.* It would contain $\frac{1}{8}$ of a cord, or $\frac{1}{8}$ of 〰 cu. ft., or 〰 cu. ft.

$\frac{1}{8}$ of 128 cu. ft. = **1 cord foot = 16 cu. ft.**

3. What will $\frac{1}{2}$ cord of wood cost at $1.75 per cord foot?

4. What will $\frac{1}{2}$ cord cost at $\$0.37\frac{1}{2}$ per cubic foot?

5. How many cords in 640 cu. ft.?

6. How many cords in a pile of 4-foot wood 12 ft. long and 8 ft. high? What is it worth at $6.75?

7. What will a pile of wood 10 ft. by 6 ft. by 4 ft. cost at $12 a cord?

8. If I pay 75 cts. for sawing a cord of wood into 2 pieces, what shall I pay for sawing it into 3 pieces?

158.—To Find the Time from One Date to Another.

The year is divided into 12 *Calendar* months as follows: —

January,	1st mo.	31 days	July,	7th mo.	31 days
February,	2nd "	28 or 29 "	August,	8th "	31 "
March,	3rd "	31 "	September,	9th "	30 "
April,	4th "	30 "	October,	10th "	31 "
May,	5th "	31 "	November,	11th "	30 "
June,	6th "	30 "	December,	12th "	31 "

When the number of a year is divisible by 4, the year is a leap year. Centennial years are exceptions unless their number is divisible by 400.

In a leap year February has 29 days.

In most business operations 30 days are considered a month.

1. In which of the following-named years will February have 29 days? 1894; 1896; 1900; 1904; 2000.
2. How many years, months, and days from July 14, 1887, to May 10th, 1893?

Work.

1893 yr. 5 mo. 10 d.
1887 yr. 7 mo. 14 d.
5 yr. 9 mo. 26 d.

Explanation. We write the 10th day of the 5th month of 1893 as the minuend, and the 14th day of the 7th month of 1887 as the subtrahend. Putting 1 of the 5 mo., or 30 days, with the 10 days, we have 40 days; 14 days from 40 days = 26 days. Putting 1 year, or 12 mo., with the 4 mo. (5 mo. − 1 mo. = 4 mo.) we have 16 mo.; 7 mo. from 16 mo., 9 mo.; 1887 yr. from 1892 yr. = 5 yr.

Find the time in years, months, and days from

3. Aug. 10, '92, to Dec. 15, '93.
4. May 15, '94, to Apr. 17, '96.
5. Dec. 26, '93, to Feb. 6, '95.
6. Sept. 27, '95, to May 11, '97.
7. Dec. 31, '98, to May 14, '99.
8. July 4, '93, to Feb. 22, '96.
9. Aug. 28, '96, to Jan. 1, '98.
10. Feb. 29, '96, to May 7, '98.
11. How old are you to-day in years, months, and days?
12. How long from Christmas, 1895, to July 4, 1900?

159.—To Find a Percentage.

[Review p. 148.]

ORAL.

1. Find 6 *per cent*, or 6 *hundredths* of $300.

Method. 1% of $300 = $3;
6% of $300 = 6 × $3, or $18.

2. What is $12\frac{1}{2}\%$ of $800?

Suggestion. Use the equivalent common fraction when possible.

Find

3. $33\frac{1}{3}\%$ of 18; of 63; of 420.
4. 7% of 200; of 900; of 4000.
5. 10% of 25; of 125; of 380.
6. $66\frac{2}{3}\%$ of 18; of 48; of 120.
7. 9% of 300; of 500; of 2000.
8. 25% of 16
9. 75% of 60
10. 40% of 45
11. 8% of 400
12. 20% of 125
13. 60% of 80

How much remained after

14. 20% of $500 was spent?
15. $16\frac{2}{3}\%$ of 60 A. was sold?
16. $66\frac{2}{3}\%$ of the year had gone?

Find the selling price when the

17. Cost is $40, and the gain $12\frac{1}{2}\%$.
18. Cost is $8, and the loss 25%.
19. Cost is 16¢, and the gain $37\frac{1}{2}\%$.
20. Cost is $18, and the loss $16\frac{2}{3}\%$.

WRITTEN.

1. What is $7\frac{1}{2}\%$ of $160?

$160 = Base
$0.07\frac{1}{2}$ = Rate per cent
80
1120
$12.00 = percentage

Base × Rate = Percentage.

The **base** is the number of which the hundredths are taken.

The **rate per cent** is the number of hundredths.

The **percentage** is what is obtained by taking hundredths of the base.

2. What is 9% of $840?
3. Find 12% of 650 tons.
4. What is $17\frac{1}{3}\%$ of 5280 feet?

Find

5. $62\frac{1}{2}\%$ of 648.
6. $31\frac{1}{4}\%$ of $6.80.
7. $6\frac{1}{4}\%$ of $927.

How much is left after

8. I spend 7% of $825?
9. I lose 35% of $6000?
10. 65% of 3500 bu. is sold?

Find what I sell for when

11. The cost = $75; gain = 8%.
12. The cost = $42; loss = 5%.
13. 18¢ = cost; $12\frac{1}{2}\%$ = gain.
14. Loss = 14%; cost, $10.80.

160.—To Find the Base of a Percentage.

ORAL.

1. 8 is ½ of what number?
2. 8 is 50% of what number?
3. 3 is ⅛ of what number?
4. 3 is 12½% of what number?
5. $18 is 6% of what number?

Method. If $18 is 6% of some number, 1% of it = ⅙ of $18, or $3; 100% of it = 100 × $3, or $300; hence $18 is 6% of $300.

6. $21 is 7% of what number?
7. $6 is 16⅔% of what?
8. 12 is 0.25 of what number?
9. 5 is $\frac{20}{100}$ of what number?

Of what number does

10. 36 = 37½%? 80%? 3%?
11. 35 = 62½% ?87½%? 7%?
12. 24 = 8%? 6%? 12%?

13. 16 cts. is 4% of James's money. How much has he?

14. How old is Ella if 14 yrs. is 87½% of her age?

15. Edward spelled 90% of his words correctly. What % did he miss? If he missed 12 words, how many did he spell correctly?

16. If you should take 15% of my money from ¼ of my money, the remainder would be $4. How much have I?

WRITTEN.

1. 6 × ⁓ = $48.

2. How do we find the multiplicand when product and multiplier are given?

Percentage ÷ Rate % = Base.

3. $4.90 is 14% of what?

Rate % = 0.14)$4.90 = Percentage.
14.)$490.($35. = Base.
42
70
70

4. $1.44 is 36% of what?

5. 256 ft. is 32% of what?

6. $249 is 37½% of what?

7. $8.50 is 17% of what?

8. I gained $12, or 8%, when I sold my horse. What did he cost me?

9. $9.10 is 13% of my money. How much have I?

10. A merchant gained 35 cts. a yard by selling cloth for 7% above cost. What did it cost him?

11. The gain is 12% of the cost, or $3.60. What is the cost?

What is the cost when

12. The gain = $8.40 or 7%?

13. The gain = 30% of cost, or $12?

14. 37½% of it = $7.50?

161.—To Find the Rate Per Cent.

ORAL.

1. $6 is what part of $8?

$6 is $\frac{6}{8}$ of $8; $\frac{6}{8} = \frac{3}{4}$ or 75%.

2. $2 is what % of $16?

$2 is $\frac{2}{16}$ of $16; $\frac{2}{16} = \frac{1}{8}$ or 12½%.

3. $10 is what % of $30?

4. What % of 18¢ is 3¢?

5. What part of 24 is 18?

6. 5 ft. is what % of 35 ft.?

7. What part of 20 remains after 16 has been taken out? What per cent remains?

8. If in an arithmetic test you answer 8 questions out of 12 correctly, what per cent do you have right? Wrong?

9. What per cent of the letters in *studious* are consonants?

10. What per cent of the months have 30 days?

11. 10 in 15 is the same as how many in 100?

12. Apples that cost $2 were sold for $3. How much was gained? What per cent of the cost was gained?

13. If you buy for $12 and sell for $15, what per cent do you gain?

14. If you buy for $15 and sell for $20?

WRITTEN.

1. ⁓ × $8 = $48.

2. When the product and the multiplicand are given, the multiplier is found by dividing the ⁓ by the ⁓.

Percentage ÷ Base = Rate %.

3. What per cent is $10 of $125?

$$\begin{array}{rl} & 0.08 = \text{Rate }\%. \\ \text{Base} = \$125 & \overline{)\$10.00} = \text{Percentage.} \\ & \underline{10.00} \end{array}$$

4. 16 is what % of 128?

5. What % of 144 is 48?

6. 144 is what % of 1728?

7. A man lost $17 out of $85. What per cent did he lose?

8. Out of 208 workmen 13 had their wages raised. What per cent had their wages raised? What per cent did not?

9. Flour costs a merchant $6.25 a barrel. What per cent does he gain if he sells it for $6.50?

10. What per cent will he gain if he buys for $8.00 and sells for $9.60?

11. 270 is what per cent of 8100?

162.—Exercises in Percentage.

ORAL.

1. How many days in $33\frac{1}{3}\%$ of the month of April?
2. One ounce is what per cent of a pound?
3. What per cent of a yard is 27 in.?
4. What per cent of a foot is 8 in.? 9 in.?
5. A faithful clerk who has $60 a month receives an increase of $16\frac{2}{3}\%$ in his salary. How much does he then receive?
6. My house is insured for $5000. The insurance costs me 1% every 5 years. How much do I pay annually?
7. If you miss 5 words out of 80, what per cent do you spell correctly?
8. What per cent of a 2-inch square is a square inch?
9. What per cent of a 2-inch cube is a cubic inch?
10. 2% of a boy's age is 4 months. What is his age in years?

WRITTEN.

11. Bought goods to the amount of $112.75, and received a discount, or reduction, of 8%. How much did I pay?
12. What per cent of a square foot in 96 sq. in.?
13. What per cent of a mile in 64 rd.?
14. What per cent of an acre in 128 sq. rd.?
15. $8\frac{1}{3}\%$ of my rent is $15. What is the whole rent?
16. The population of a town in 1890 was 7500. If it gains 44% what will be its population in 1900?
17. I buy a house for $6000. What per cent shall I gain if I sell it for $7200?
18. What is 150% of $750?
19. Wood costs me $7.50 a cord. What shall I ask for it to gain 25%?
20. What per cent shall I lose if I sell it for $6.00?
21. $42 is 7% of the cost of a piano. What shall I gain if I sell it for $750.
22. What per cent shall I lose if I sell it for $570?

163. — Interest.

ORAL.

1. I pay $20 a month for the *use* of another man's house. What is my *rent* for 5 months?
2. A livery-stable keeper charges me $0.50 an hour for the *use* of a horse and buggy. How much must I pay for *horse-hire* for 4 hours?
3. Henry Ward pays $1.00 for the use of a bicycle for 5 hours. What is the rate per hour?
4. Is it just that one who uses another's property should pay for the use of it? What is rent? Horse-hire?
5. I use $100 belonging to Mr. Brown, agreeing to pay him $6 if I use it a year. What should I pay him if I use the money 2 years? What if I use it 6 months?
6. $6 is what per cent of $100?
7. I can hire money by paying 5 cents for the use of $1 for a year. What shall I pay for the use of $50 for a year at this rate?
8. At the same rate, what should I pay for the use of $50 for 2 years?

Money paid for the use of money is **Interest.**

9. What is meant by the *interest* of $100 for a year?
10. 6 cents is what per cent of 100 cents? $5 of $100?
11. If I pay 7 cents interest for $1.00 for a year, what interest should I pay for 3 years? For $5 for a year? For $5 for 2 years? For $100 for a year?

The money for which interest is paid is the **Principal.**

12. Mention the principal in Exercise **8**. In Exercise **9**.

The **rate** of interest is the per cent of the principal paid for a year's use of it.

13. If I pay 5¢ for the use of 100¢ for a year, I pay ~ % interest.
14. What is the rate if I pay $6 a year for the use of $100?

164.—General Method of Finding Interest.

ORAL.

1. What is meant by the expression 6% interest?

2. What is a year's interest of $100 at 6%?

At 6%, what is the interest of

3. $200 for 1 yr.? For 2 yr.? For 3 yr.? For 6 mo.?

4. $300 for 1 yr.? For 6 mo.? For $\frac{1}{4}$ yr.? For 4 mo.?

5. $500 for 1 yr.? For 2 yr.? For 6 mo.? For 2 yr. 6 mo.?

At 5%, what is the interest of

6. $400 for 1 yr.? For 2 yr.? For 3 mo.? For 9 mo. ($\frac{3}{4}$ yr.)?

7. $60 for 1 yr.? For 4 yr.? For $\frac{1}{2}$ yr.? For 4 mo.?

8. $1200 for 1 yr.? For 1 mo. ($\frac{1}{12}$ yr.)? For 5 mo.? For 7 mo.?

9. At 8%, what is a year's interest of $500? 2 years'?

10. At 10%, what is 2 years' interest of $80?

WRITTEN.

11. What shall I pay for the use of $84 for 2 yr. 5 mo. at 5% a year?

Work. $84 = Principal.
0.05 = Rate for a year.
$4.20 = 1 year's interest.
$2\frac{5}{12}$ = Time in years.

$$\begin{array}{r} 12\overline{)2100} \\ 175 \\ \underline{840} \end{array}$$

$10.15 = 2½ years' interest.
$\underline{84.}$
$94.15 = Amount.

Explanation. 1 year's interest = 5% of the principal, or $4.20; $2\frac{5}{12}$ years' interest = $2\frac{5}{12}$ × $4.20, or $10.15. The interest added to the principal gives the *amount*.

Remark. In finding interest, work with four decimal places when necessary, but give results to the nearest cent.

Find the interest of

12. $45 for 2 yr. at 7%.

13. $28 for 3 yr. at 5%.

14. $36 for 1 yr. 6 mo. at 4%.

15. $75 for 2 yr. 3 mo. at 6%.

16. $96 for 3 yr. 4 mo. at 7%.

17. $125 for 2 yr. 8 mo. at 8%.

18. $160 for 1 yr. 9 mo. at 3%.

What is the amount of

19. $258 for 2 yr. 10 mo. at 5%?

20. $360 for 1 yr. 5 mo. at 4%?

21. $144 for 1 yr. 7 mo. at 10%?

22. $172.80 for 10 mo. at 8%?

23. $168.40 for 3 mo. at 9%?

24. $75.25 for 4 mo. at 3%?

25. $86.84 for 14 mo. at $7\frac{1}{2}$%?

165.—Interest: the Six Per Cent Method.

WRITTEN.

1. At 6%, the interest of $1.00 for 1 yr. is $0.06. At the same rate, what is the interest of $1.00 for 2 yr.? What is it for 3 yr.? For 4 yr.? For 5 yr.?

2. When the interest of $1.00 for a year is $0.06, the interest for 1 month, or $\frac{1}{12}$ of a year, is $\frac{1}{12}$ of 6 cents, or $\frac{6}{12}$ of a cent, or $\frac{1}{2}$ cent, or $0.005.

The interest of $1 for 2 mo. = 〰 × $\frac{1}{2}$¢, or 〰
" " " " " 3 " = 〰 × 〰, or 〰

3. At 6% a year, what is the interest of $1 for 4 mo.? For 5 mo.? For 6 mo.? For 7 mo.? For 9 mo.? For 11 mo.?

4. What is the interest of $200 for 2 yr. 9 mo.?

Note. When no rate of interest is mentioned in connection with exercises in this book, 6% per year is to be understood.

Work.

$$\text{Int. of \$1.00 for}\begin{cases}2\text{ yr.} \;\;= 2\times 6\text{¢} = \$0.12\\ 9\text{ mo.} = 9\times\frac{1}{2}\text{¢} = \underline{\;\;0.045}\\ 2\text{ yr. }9\text{ mo.} \quad\;\; = \$0.165\end{cases}$$

$$\underline{\quad 200}$$

$$\text{Int. of \$200} = 200\times\text{int. of \$1} = \$33.000$$

5. What is the interest of $300 for 1 yr. 4 mo.?
6. What shall I receive for the use of $500 for 2 yr. 3 mo.?
7. What must you pay for the use of $120 for 3 yr. 5 mo.?
8. Compute the interest of $175 for 3 yr. 7 mo.
9. What is the interest when the principal is $218 and the time 4 yr. 9 mo.?

Find the interest of

10. $360 for 2 yr. 1 mo.
11. $22.50 for 3 yr. 3 mo.
12. $98 for 4 yr. 5 mo.
13. $287 for 3 yr. 7 mo.
14. $64.75 for 5 yr. 9 mo.

Find the amount of

15. $495 for 7 yr. 11 mo.
16. $510 for 4 yr. 8 mo.
17. $37.50 for 1 yr. 5 mo.
18. $62.80 for 27 mo.
19. $975 for 21 mo.

166.—Interest: the Six Per Cent Method.

WRITTEN.

1. At 6%, what is the interest of $1 for a year? For 1 month? $\frac{1}{2}$ a cent equals ⁓ mills.

Note. In computing interest, 30 days = 1 month; 360 days = 1 year.

2. If the interest of $1 for 30 days is 5 mills, what will the interest for 1 day be?

If 30 days' interest = 5 mills, 1 day's interest = $\frac{1}{30}$ of 5 mills = $\frac{5}{30}$ of a mill, or $\frac{1}{6}$ of a mill, or 0.000\frac{1}{6}$.

3. If 1 day's interest = $\frac{1}{6}$ of a mill, 6 days' interest = $6 \times \frac{1}{6}$ mill = 1 mill, or $0.001. What is the interest of $1 for 12 days?

4. Find the interest of $1 for 18 days. For 24 days. For 3 days.

What is the interest of $1 for

5. 9 days?
6. 15 days?
7. 21 days?
8. 27 days?
9. 10 days?
10. 20 days?
11. 26 days?
12. 29 days?

13. Find the interest of $300 for 2 yr. 11 mo. 23 d.

Work.

$$\begin{array}{lr}
\text{Int. of \$1 for} \left\{ \begin{array}{lll} \text{2 yr.} & = 2 \times 6¢ & = \\ \text{11 mo.} & = 11 \times \frac{1}{2}¢ & = \\ \text{23 d.} & = 23 \times \frac{1}{6}\text{ m.} & = \end{array} \right. & \begin{array}{r} \$0.12 \\ 0.055 \\ \underline{0.003\frac{5}{6}} \end{array} \\
\text{Int. of \$1 for 2 yr. 3 mo. 23 d.} \quad = & \$0.178\frac{5}{6} \\
 & 300 \\
 & 6\overline{)1500} \\
 & 250 \\
 & \underline{534} \\
\text{Int. of \$300} = 300 \times \text{\$1's int.} \quad = & \$53.650
\end{array}$$

To find the interest *of* $1 *at* 6%, *count*

6¢ for each year;
$\frac{1}{2}$¢ for each month;
$\frac{1}{6}$ m. for each day.

Find the interest of

14. $5 for 1 yr. 10 mo. 12 d.
15. $8 for 2 yr. 8 mo. 24 d.
16. $9 for 3 yr. 5 mo. 13 d.
17. $12 for 2 yr. 7 mo. 19 d.
18. $10 for 1 yr. 6 mo. 15 d.
19. $20 for 3 yr. 9 mo. 18 d.
20. $30 for 4 yr. 11 mo. 25 d.
21. $42 for 1 yr. 7 mo. 10 d.
22. $72 for 1 yr. 8 mo. 3 d.
23. $96 for 2 yr. 1 mo. 29 d.
24. $108 for 3 yr. 3 mo. 11 d.
25. $14.40 for 7 mo. 20 d.
26. $28.44 for 1 yr. 27 d.
27. $504 for 63 d.

167.—Interest at Any Rate Per Cent.

WRITTEN.

1. If the interest at 6% is $24, what is the interest at 1%?
2. $30 is 6% interest. What is 3% interest? 2%?
3. What part of 6% is 1%? 2%? 3%? 4%? 5%?
4. If I should add 2% interest to 6% interest, I should have the interest at ⁓ %.
5. 1% interest taken from 6% interest gives ⁓ % interest.

After we have found the interest at 6%, we may find the interest at another rate by adding or subtracting the proper part of 6% interest.

Remember that

$1\% = \frac{1}{6}$ of 6%
$1\frac{1}{2}\% = \frac{1}{4}$ of 6%
$2\% = \frac{1}{3}$ of 6%
$3\% = \frac{1}{2}$ of 6%

$4\% = 6\% - 2\%$
$4\frac{1}{2}\% = 6\% - 1\frac{1}{2}\%$
$5\% = 6\% - 1\%$
$7\% = 6\% + 1\%$

$8\% = 6\% + 2\%$
$9\% = 6\% + 3\%$
$10\% = 10 \times 1\%$
$11\% = 11 \times 1\%$

6. Find the interest of $70 for 2 yr. 9 mo. 12 d. at 4%.

Work.

Int. of $1 for		$0.167	
2 yr. =	$0.12	70	
9 mo. =	0.045	3)$11.690	= 6% int.
12 d. =	0.002	3.896+	= 2% "
	$0.167	$7.794	= 4% "

7. What is the interest of $8 for 3 yr. 1 mo. 18 d. at 7½%?

Work.

Int. of $1 for		$0.188	
3 yr. =	$0.18	8	
1 mo. =	0.005	4)1.504	= 6% int.
18 d. =	0.003	0.376	= 1½% "
	$0.188	$1.880	= 7½% "

Find the interest under the following conditions:—

	Principal.	*Time.*	*Rate.*
8.	$25	1 yr. 3 mo. 7 d.	5
9.	$48	2 yr. 4 mo. 12 d.	7
10.	$75	8 mo. 15 d.	4
11.	$84	3 yr. 26 d.	8
12.	$108	4 mo. 19 d.	9
13.	$270	4 yr. 3 mo.	4½
14.	$195	93 d.	3
15.	$277	1 yr. 8 d.	2
16.	$48.60	2 mo. 17 d.	10
17.	$74.96	108 d.	11
18.	$85.14	1 yr. 19 d.	8
19.	$73.62	6 mo. 5 d.	7
20.	$84.06	84 d.	4
21.	$178.12	109 d.	7½
22.	$242.18	26 mo.	9
23.	$647.91	117 d.	5

168.—Exercises in Interest.

WRITTEN.

1. Mr. Adams allows Mr. Brown the use of $84 from May 17, 1891, to Dec. 17, 1893, at 4%. What should be paid for the use of the money?
2. Aug. 25, 1893, I hire $382, agreeing to pay 5% interest. How much will pay both principal and interest Feb. 25, 1895?
3. On the 25th of September, 1893, William Howard, who lives in Springfield, borrows $96 of Henry Stevenson, promising him in writing to repay the money whenever Mr. Stevenson asks for it, together with interest at 7%. The debtor gives the following written promise, or ***promissory note***. Mr. Stevenson is the *payee*. Who is the ***maker*** of the note? Who will keep it? Why? How long?

$96— *Springfield, Sept. 25, 1893.*

On demand after date I promise to pay to the
order of Henry Stevenson
Ninety-six Dollars,
with interest at seven per cent.
Value received.
William Howard.

4. Suppose payment of this note is demanded March 31, 1895. How much will Mr. Stevenson receive?
5. $125 is borrowed Dec. 17, 1894, at 8%. What amount will settle the note May 5, 1896?
6. A note is paid Oct. 19, 1895. Its *face* — the money named in the note — is $200; the date, May 4, 1893. What is due?
7. How much will settle a note for $800, drawing 10% interest from Aug. 17, 1894, to Jan. 15, 1897?

169.—Review Exercises.

ORAL.

1. Mention four factors of 72.
2. What is the difference between an abstract and a concrete number?
3. If 9 balls weigh 45 ounces, what will 13 balls weigh?
4. Count the change from a $2-bill for $7\frac{1}{2}$ doz. buttons at 15 cents a dozen.
5. How many times is $7\frac{1}{2}$ contained in $3\frac{3}{4} \times 7\frac{1}{2}$?
6. If I spend $\frac{3}{4}$ of my money and $12, I shall have nothing left. How much have I?
7. $\frac{5}{6}$ of $102= what?
8. 3% of 400= what?
9. Add $\frac{3}{4}$ and $\frac{3}{7}$.
10. $15 is $\frac{3}{11}$ of what?
11. 20 is 4% of what?
12. Take $2\frac{1}{2}$ from $3\frac{1}{4}$.
13. July 1, 1887, my daughter was 12 years old. What is her age at the present time?
14. A boy who works for $3 a week pays 15 cents daily for his lunch and 60 cents a week for fares. How much has he left Saturday night?
15. How many square yards in a table-cloth measuring 72 inches one way and $4\frac{1}{2}$ yards the other?
16. How many pounds of sugar at $6\frac{1}{4}$¢ can I buy for $1?
17. 32 pounds is $33\frac{1}{3}$% of George's weight. How much does he weigh?
18. How many inches in $\frac{1}{2}$ a rod?
19. If a horse trots a mile in 2 min. 8 sec., how long will he be in trotting 10 miles at that rate?

Find the cost of

20. $\frac{3}{4}$ yd. calico @ 10¢
$1\frac{2}{3}$ yd. ribbon @ 18¢

21. $8\frac{1}{2}$ lb. chicken @ 12¢
6 lb. steak @ $16\frac{2}{3}$¢

22. For what shall I sell a house that cost me $1200 to gain 25%?
23. Louise spelled 92% of her words correctly, but missed 16. How many did she try to spell?

170. — Review Exercises.

ORAL.

1. Compare the cost of $2\frac{1}{3}$ pounds of tea with the cost of 14 pounds.

2. Edward's age is $\frac{2}{3}$ of his cousin's. If Edward is 16, how old is his cousin?

3. When was a man born who is 43 years old to-day?

4. How many chairs at $2.50 can you buy for $20?

5. How many pieces of ribbon $\frac{3}{4}$ yd. long can be cut from 7 yards? How large a piece will remain?

6. How long will a gross of pens last a school of 48 pupils if a new pen is given out every 2 weeks?

See how quickly you can subtract the sum of each two of these numbers from their product: —

7.
$$\begin{array}{cccccccccccc} 4 & 5 & 8 & 6 & 12 & 3 & 6 & 8 & 9 & 7 & 9 & 8 \\ \underline{8} & \underline{4} & \underline{2} & \underline{5} & \underline{8} & \underline{7} & \underline{7} & \underline{6} & \underline{10} & \underline{8} & \underline{7} & \underline{5} \end{array}$$

8. 8% of 500? **10.** $\frac{1}{6}$ of $\frac{3}{4}$? **12.** $8\frac{1}{3}$ is $\frac{1}{12}$ of what?
9. $66\frac{2}{3}$% of 900? **11.** $3\frac{2}{3} \times 12$? **13.** $12 is $8\frac{1}{3}$% of what?

14. What is the interest of $200 for $2\frac{1}{2}$ yr. at 4%?

15. At 4%, what is the interest of $1000 for 9 months?

16. What hour is the middle of the day? When does the exact middle of the week come? Of the month of May? Of an ordinary year?

17. After losing $\frac{4}{7}$ of his kite string, Charles had 600 ft. still remaining. How many feet had he originally?

18. How many inch cubes will a 2-inch cubical box hold? A 4-inch box will hold ⁓ times as many.

19. If you live 40 rd. from school, how many miles do you travel every week in going to school and returning?

20. Count by 13's from 0 to 100. **22.** 100 eggs = ⁓ doz.
21. Count by $3\frac{1}{3}$ from 0 to 50. **23.** 100 oz. = ⁓ lb.

24. What will 1500 cu. ft. of gas cost at $2 a thousand?

171.—Review Exercises.

ORAL.

1. What part of 100 is 25? 75? $16\frac{2}{3}$? $66\frac{2}{3}$? $12\frac{1}{2}$? $62\frac{1}{2}$? $87\frac{1}{2}$?
2. What number multiplied by itself = 16? 36? 25? 81? 49?
3. One of the two equal factors of a number is called its *square root.* The square root of $64 = 8$, for $8\times 8=64$. $\sqrt{81}=$ the square root of 81, or 9. $\sqrt{100}=\sim$; $\sqrt{4}=\sim$; $\sqrt{121}=\sim$; $\sqrt{144}=\sim$; $\sqrt{400}=\sim$.
4. Compare a cubic foot and a cubic yard.
5. Compare the weight of a cubic inch and a cubic foot.
6. A barrel of flour weighs 196 pounds. What does a bag containing $\frac{1}{4}$ of a barrel weigh?

What shall I be obliged to pay for

7. $\frac{3}{4}$ lb. @ 25¢; $1\frac{1}{2}$ lb. @ 50¢?
8. $\frac{7}{8}$ yd. @ 50¢; $\frac{2}{3}$ doz. @ 10¢?
9. $\frac{5}{8}$ doz. @ $1; $\frac{1}{6}$ doz. @ $2?

10. At $6 a cord, what will 1 cord foot of wood cost?
11. At $8 a ton, what will 3000 lb. of coal cost?
12. At $9 a year, what shall I pay for a newspaper for 2 mo.?
13. $0.8\times 0.6=\sim$
14. $4.8\div 0.4=\sim$
15. 0.0001 of $4800=\sim$
16. $87\frac{1}{2}\%$ of $640=\sim$
17. $33\frac{1}{3}\div 16\frac{2}{3}=\sim$
18. $87\frac{1}{2}\div 12\frac{1}{2}=\sim$
19. How many aprons, each requiring $\frac{3}{4}$ of a yard, can be made from 20 yards of cloth?
20. If $\frac{5}{9}$ of a pound costs 15¢, what will $\frac{2}{3}$ of a pound cost?
21. Take $\frac{2}{5}$ of a number out of it, and 36 remains. What is the number?
22. If $24 is the interest at 6%, what is the interest at 8%?
23. The sum of three numbers is 30. The first is $8\frac{1}{2}$, and the second $7\frac{3}{4}$. Find the third.
24. By selling for $8 I gain $2. What per cent of the cost do I gain?
25. What per cent of the day has gone at 6 P.M.?
26. Compare the area of a 2-in. cube with that of a 4-in. cube.

172.—Review Exercises.

ORAL.

1. If 12 lb. of starch cost \$0.72, what will $8\frac{1}{2}$ lb. cost?
2. If 4 men can build a fence in 12 days, how many days will 9 men require?
3. Change these fractions to per cents: $\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$, $\frac{7}{8}$.
4. My telephone rent is \$100 per year. What shall I have to pay for 5 months?
5. What is a year's interest of \$40 at $4\frac{1}{2}\%$?
6. 1% of a man's age is 3 months. How many years old is he?
7. Bought a pair of boots for \$6 and sold them at a loss of $16\frac{2}{3}\%$. How much did I receive for them?
8. Take 13 + 17 + 19 + 21 + 25 from 200.
9. How many square rods in $\frac{7}{8}$ of an acre?
10. A piece of ground contains an acre and is 10 rd. wide. How long must it be?
11. At \$10 a week, what is my board bill for 15 days?
12. A grocer buys a barrel of pork — 200 lb. — for \$12, and sells it at 8¢ a pound. What does he gain on a pound? On the barrel? What is his per cent of gain?
13. If $\frac{5}{8}$ of a ton of coal costs \$4, what will $2\frac{1}{2}$ tons cost?
14. What is my December milk bill? I take 3 pt. daily. The price is 8¢ a quart.
15. Find the cost of 20 eggs at 20 cents a dozen.

16. $\frac{6}{7}$ of 42 = 〰
17. 48 is $\frac{?}{9}$ of 72
18. 21 is $87\frac{1}{2}\%$ of 〰
19. $\frac{3}{4}$ of $6\frac{2}{3}$ = 〰
20. $\frac{7}{8} \div \frac{3}{5}$ = 〰
21. $9 \times 4\frac{4}{5}$ = 〰
22. $\frac{6}{7}$ + 〰 = $1\frac{3}{4}$
23. $\frac{3}{5} \times$ 〰 = 12
24. 18 is 36% of 〰

25. What is the interest of \$10 for 24 days at 6%?
26. Find the interest of \$12 for 10 months at 6%.
27. Thomas has \$50. 20% of his money is $\frac{1}{2}$ of Fred's. How much has Fred?
28. If I should sell an article for $\frac{7}{8}$ of its cost, what per cent should I lose?

173.—Review Exercises.

ORAL.

1. Separate $5 into 200 equal parts.
2. What does the larger term of a proper fraction show?
3. How may you know the denominator of a decimal fraction?
4. Compare the cost of 4 oranges with the cost of 12 oranges.
5. If 4 oranges cost 6⅔¢, what will 12 oranges cost?
6. Compare the cost of 15 hats with the cost of 3 hats.
7. If 15 hats cost $26, what will 3 hats cost?
8. What per cent of the letters in *Columbus* are vowels?
9. What per cent are these numbers of 144: 72? 48? 36? 24? 12?
10. Give the difference between 100 and 67; 84; 19; 37; 46.
11. Quickly mention the factors of 144; 121; 96; 72; 63; 108.
12. Give the squares of 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12.
13. What is the value of $\sqrt{36}$; $\sqrt{64}$; $\sqrt{25}$; $\sqrt{81}$; $\sqrt{49}$; $\sqrt{144}$?

What must you pay for these articles:—

14. ¾ yd. gingham @ $0.37½
15. ⅝ yd. silk @ $1.25
16. ⅓ doz. pins @ $0.66⅔
17. 2¼ lb. butter @ $0.19

Find the selling price when the

18. Cost = $12; gain = 12½%
19. Cost = $15; loss = 66⅔%
20. Cost = $1.50; gain 30%
21. Cost = $2.75; loss 20%

22. Compare the interest of $60 with that of $180.
23. What date comes 18 days after March 21st, 1893?
24. What is the interest of $50 for 60 days at 6%?
25. Find 8 months' interest, at 9%, of $500.
26. When you add 16 to a certain number the result is the same as when you take ⁶⁄₅ of it. What is the number?
27. Divide 75 cents among 3 boys, giving the first 9 cents more than each of the others.
28. How many times is 8⅓% of 48 contained in ³⁄₁₆ of 112?
29. What will 3 doz. lemons cost at 4 for 12¢?

174.—Review Exercises.

WRITTEN.

a.	$329.84
b.	649.76
c.	457.83
d.	804.70
e.	369.64
f.	184.78
g.	697.23
h.	854.35
i.	564.87
j.	896.36
k.	465.93
l.	840.67
m.	295.48
n.	364.21
o.	967.99

1. Without rewriting the numbers at the left, find the sum from **a** to **g** inclusive.
2. Add from **b** to **k** inclusive.
3. Add from **o** to **g** inclusive.
4. Find the sum of **d** to **o** inclusive.
5. Find the difference between **a** and **b**.
6. Add **d** – **c** to **e** – **f**.
7. Add **h** – **g** to **k** – **i**.
8. Take the smallest number in the column from the sum of the two largest.
9. Add 4 × **a** to 6 × **l**.
10. Take ⅑ of **k** from ¼ of **e**.
11. Find the sum of the column.
12. Use this column for practice in addition as your teacher may dictate.
13. What number shall I obtain by adding 637 to itself 97 times?
14. I bought 27 horses at $135 each, and sold them at an average gain of $14.50. What did I receive for them?
15. At $14.75 each, how many tables can be bought for $1000?

Find the amount of the following purchases:—

16. 18 tons coal @ $5.75
7½ cd. wood @ 12.50

17. 27 bbl. flour @ $4.69
208 bu. oats @ 0.62½

18. What should be my selling price for the above-mentioned articles to gain 20%?
19. If 47 bbl. of apples sell for $98.23, what will 59 bbl. sell for?
20. Take ⅔ of 47,639 from ⅚ of 73,620.
21. How many 999's in half a million?
22. Find the value of ten thousand thousand-dollar bills?
23. If a grocer buys oil at 8¢ a gallon and sells it for 3½¢ a quart, what will he gain on a barrel of 42 gallons?

WRITTEN.

1. Four boys weigh 84, 75, 106, and 64 pounds respectively. What is the average weight? (The sum ÷ 4.)
2. Their ages are $11\frac{5}{6}$ yr., $9\frac{2}{3}$ yr., $12\frac{1}{2}$ yr., $8\frac{3}{4}$ yr. Find their average age.
3. Subtract $19\frac{6}{7}$ from $305\frac{1}{8}$. 4. $\frac{6}{7}$ of $2\frac{4}{5} =$ what?

Find the amount of the following sales: —

5. 3 boxes sardines @ $8.75 a dozen 6. $11\frac{3}{4}$ lb. @ $12\frac{1}{2}$¢
5 jars ginger @ $11.00 a dozen $\frac{15}{16}$ oz. @ 25¢

7. Draw a rectangle to represent a floor 18 ft. wide and 24 ft. long. How many breadths of yard-wide carpet will it require? Each breadth will be ⁓ yards long. What will the carpet cost at $1.25 per yard?
8. If the carpet is only $\frac{3}{4}$ yd. wide, how many breadths will be needed? What will this carpet cost at $$1.37\frac{1}{2}$ a yard?
9. If a single rail is 2 rods long, how many will be needed for a mile of *double* railroad track?
10. What will ties enough for the track cost at $17\frac{1}{2}$¢ each, if they are laid 6 to a rod?
11. Draw 6 rectangles to represent the surface of a box 6 in. long, 4 in. wide, and 2 in. deep, and find the area.
12. If $\frac{5}{6}$ of a house is worth $3755, what is $\frac{3}{4}$ of it worth?
13. What will 1200 lb. of coal cost at $$4.87\frac{1}{2}$ a ton?
14. $2\frac{1}{2}$ miles = ⁓ ft. 17. $4\frac{7}{8}$ cu. ft. = ⁓ cu. in.
15. $6\frac{3}{4}$ □-ft. = ⁓□-in. 18. $3\frac{4}{5}$ A. = ⁓ □-rods
16. 1280 ft. = ⁓ rd. 19. $4\frac{15}{16}$ cd. = ⁓ cu. ft.
20. If a cubic foot weighs 484 lb., what will 864 cu. in. weigh?
21. Reduce $375.80 by 37% of itself.
22. What is the interest of $648 for 2 yr. 4 mo. 19 da.?
23. A note is dated May 14, 1895; its face is $65; it draws 4% interest. Write the note and find what will settle it Aug. 20, 1897.

176.—Review Exercises.

WRITTEN.

1. Edwin Gay, who lives in Albany, pays Mrs. Mary Howe for $8\frac{2}{7}$ weeks' board at $9 a week. She gives him a receipt for the amount Aug. 27, 1894. Properly fill out for her the following

BLANK RECEIPT.

$ Money (in figures). City. Date. *189* .

Received *from* Name of person paying money.

Amount of money received (in words). $\frac{\quad}{100}$ *Dollars*

for What paid.

Signature of receiver.

2. An oil-tank is 6 ft. square and 4 ft. deep. How many gallons will it hold, every cubic foot containing $7\frac{1}{2}$ gallons?
3. Bought 8 barrels of kerosene, 42 gallons in a barrel, at $6\frac{3}{4}$¢, and sold it at $12\frac{1}{2}$¢ a gallon. How much did I gain?
4. How many yards of carpet will be needed for a flight of stairs of 12 steps, each 8 in. high and 10 in. wide? Allow 2 ft. to turn under.
5. $10 for 1500 lb. of coal is how much a ton?
6. From $42\frac{3}{4}$ yd. of silk $\frac{2}{3}$ of it was sold. What remains?

Find the cost of the following articles:—

7. 376 barrels @ $$4.62\frac{1}{2}$
8. $1\frac{7}{8}$ yds. @ $$1.87\frac{1}{2}$
9. 17 gross @ $2\frac{3}{8}$¢
10. 10,768 sq. ft. land @ $11\frac{3}{8}$¢
11. $\frac{4}{15}$ of an A. @ $275
12. 36 tons @ $3.50 less 5%
13. How many hours from 10.15 A.M. of Monday to noon Friday?
14. If $5\frac{7}{8}$ gal. cost $9.40, what will $16\frac{4}{5}$ gal. cost?
15. At $18\frac{3}{4}$ m. an hour, how long will 1000 m. travel require?
16. $80, or 16% of my money, was stolen. How much remained?

WRITTEN.

1. Make a drawing of a farm 80 rd. long and 60 rd. wide. What is its value at $150 an acre?
2. How many cubic feet of earth will be removed in digging a cellar 20 ft. long, 16 ft. wide, and 8 ft. deep? How many loads, a cubic yard making one load?
3. Make out Charles Brackett's bill for $3\frac{1}{4}$ days' work for Dr. F. E. Bryant at $2.75, and 300 ft. of hemlock boards at $16 per M. Receipt it for him.

4. Copy and balance the following account:—

Dr. CASH. *Cr.*

1894				*1894*			
May 1	*On hand*	*237*	*85*	*May 2*	*By Mdse.*	*69*	*84*
5	*To Rent*	*67*	*50*	*3*	*" Piano*	*350*	*00*
6	*" Mdse.*	*87*	*29*	*5*	*" Clothing*	*28*	*76*
10	*" Land*	*850*	*62*	*7*	*" Book-case*	*45*	*00*

5. David Alden pays you for $18\frac{3}{4}$ yd. of carpet at $1.50. Write a suitable receipt for the money.
6. What is the capacity, in cubic feet, of a car 18 ft. long, 8 ft. wide, and 7 ft. high?
7. At $3\frac{1}{2}$¢ per square foot what shall I pay for a lot of land 225 ft. long and 96 ft. wide?
8. What shall I pay for a pile of 4-ft. wood 6 ft. high, and 12 ft. long, at $8 a cord?
9. What will settle a note that has been drawing interest for 105 days at 5%? Its face is $80.
10. Bought a typewriter for $120, and sold it for $100. What per cent did I lose?
11. What per cent should I have gained if I had sold it for $150?

178.—Review Exercises.

WRITTEN.

1. Find $\frac{7}{8}$ of $9 \times 3\frac{5}{6}$
2. $0.1728 \div 0.8$ of 2.4
3. $16\frac{4}{15} \div 7\frac{3}{25} =$ what?
4. $16\frac{2}{3}\%$ of $8\frac{1}{2} \times \$0.24$
5. 34 is 17% of what?
6. What % of 50 is $18\frac{3}{4}$?
7. How many acres in $\frac{3}{8}$ of a square mile?
8. If a wheel turns once in going $16\frac{1}{2}$ ft., how many times will it turn in going 8 m.?
9. $3\frac{1}{2}$ cu. ft. = ⁓ cu. in.
10. 14 lb. 9 oz. = ⁓ ounces.
11. 2000 inches = ⁓ yd. ⁓ ft.
12. $\frac{8}{16}$ of a □-foot = ⁓ □-in.

Find what will pay for the following purchases:—

13. $16\frac{3}{4}$ bu. oats @ 53¢
$\frac{7}{8}$ ton hay @ \$18
$2\frac{3}{5}$ bu. corn @ $66\frac{2}{3}$¢

14. $8\frac{5}{12}$ doz. rakes @ \$8.00
$6\frac{7}{12}$ doz. shovels @ \$10.00
$4\frac{1}{12}$ doz. hoes @ \$4.50

15. At 75¢ a square rod, what will it cost to concrete a school-yard 84 ft. long and 60 ft. wide?
16. At a tenth of a mill each, what will a million pins cost?
17. After spending $\frac{7}{16}$ of my money and giving away $\frac{1}{12}$ of it, I had \$1.15 left. How much had I at first?
18. If you should hire money at $4\frac{1}{2}\%$ for a year and let it at 6%, what would you make on every \$1000 of the principal?
19. The salary of the President of the United States is \$50,000 a year. What is this for a day?
20. Find the cost of a bushel when 3 pk. and 4 qt. cost 75 cts.
21. A pile of wood contains $3\frac{1}{2}$ cords; it is 4 ft. wide and 8 ft. high. How long is it?
22. The product of two numbers is $15\frac{3}{5}$; $\frac{3}{4}$ of one of them is 9. What is the other?
23. What is the value of a note for \$245 dated May 15, 1891, drawing $7\frac{1}{2}\%$ interest till Aug. 25, 1894?

179.—Review Exercises.

WRITTEN.

1. William F. Haven buys of G. A. Ware & Co. $3\frac{3}{4}$ yd. of broadcloth at $5.75 a yard, and pays for it by giving them a *check*, that is, an order on a bank in which he has money deposited. Find the amount that should be inserted in the blank spaces.

A Bank Check.

$------ *Chicago, Oct. 15, 1894.*

THE FIRST NATIONAL BANK

Pay to the order of *G. A. Ware & Co.*

------------------------------------ $\frac{\quad}{100}$ *Dollars.*

No. 16 *William F. Haven.*

2. A *long* ton weighs 2240 pounds. I buy 1000 long tons of coal at the mines, and sell it by the short or ordinary ton. How many tons do I sell?
3. Multiply 0.008 × 5.76 and divide the product by 0.144.
4. I pay $0.75 per square yard for re-slating a blackboard 28 ft. long, and $4\frac{1}{2}$ ft. wide. Find the cost.
5. How many days after July 4th does Dec. 25th come?
6. What is the cost of a mahogany board $5\frac{1}{2}$ ft. long and 20 in. wide at $1.25 a board-foot?

Make out bills for the following merchandise: —

7. 1600 ft. spruce @ $24.50
   900 ft. pine @ $32.75
8. $3\frac{5}{12}$ doz. hats @ $14.75
   $1\frac{7}{12}$ doz. hats @ $8.50
9. My room is 15 ft. by 11 ft. How many breadths of yard-wide carpet must I buy, and what will it cost at $\$1.62\frac{1}{2}$ a yard?
10. What is the amount of $488 at $4\frac{1}{2}\%$ interest from Aug. 27, 1894 to March 15, 1896?

180. — Review Exercises.

WRITTEN.

1. $15\frac{2}{3}$ is $\frac{1}{2}$ of one number and $\frac{1}{3}$ of another. What is the difference between the two numbers?
2. How many times is a square yard contained in an acre?
3. I spend $\frac{2}{9}$ of my money and $\frac{1}{2}$ of the remainder. What part have I left?
4. $12\frac{1}{2}\%$ of a certain sum of money is $\$12\frac{1}{2}$ more than $16\frac{2}{3}\%$ of it. What is the sum?
5. April 15, 1893, a gentleman died at the age of 72 yr. 3 mo. 8 da. What was the date of his birth?
6. A pile of wood 6 ft. high covers 40 sq. ft. of ground. What is the pile worth at $\$7$ a cord?
7. Compare the lengths, areas, and contents of a 4-foot cube and an 8-foot cube.
8. I lost $\$200$ by selling a house for $8\frac{1}{3}\%$ less than its cost. Find cost and selling-price.
9. The area of a square is 576 sq. in. A circle of the same diameter contains 0.7854 of this area. What is the area of the circle?
10. A note for $\$125$ has been drawing 8% interest since May 24, 1890. What is the value of the note June 5, 1895?
11. Paul missed 48 words in a month out of 576 which were given him. What per cent did he spell aright?

Find the amount of the following sales: —

12.	$\frac{3}{4}$ lb. @ $\$0.25$	13.	$\frac{5}{12}$ doz. @ $\$3.00$	14.	800 lb. @ $\$4$ a ton
	$\frac{7}{8}$ lb. @ 0.50		$1\frac{1}{12}$ doz. @ 1.00		1600 lb. @ 6 a ton
	$1\frac{2}{3}$ yd. @ 1.00		$2\frac{7}{12}$ doz. @ 0.75		9500 ft. @ 18 a M.
	$\frac{3}{4}$ yd. @ 1.25		$5\frac{1}{2}$ doz. @ $1.87\frac{1}{2}$		1200 ft. @ 24 a M.
	$\frac{15}{16}$ lb. @ 0.80		$\frac{11}{12}$ doz. @ 15.00		750 ft. @ 60 a M.

15. A workman receives $16\frac{2}{3}$¢ a hundred for making screws. If he makes 150 in an hour, how much does he earn in a day of 10 hours?

WRITTEN.

1. Monday morning my cash on hand is $157.86; Tuesday I buy 5000 lb. of hay at $18 a ton; Wednesday I sell 1584 sq. ft. of land at $18\frac{3}{4}$¢; Thursday I pay 5 months' rent at $400 a year. How much money have I on hand Friday morning?
2. If $11\frac{2}{3}$ doz. eggs cost $$3\frac{4}{15}$, what will $18\frac{3}{4}$ doz. cost?
3. At $23.75 each, how many mattresses may be bought for $500, and how much money will remain?
4. In multiplication where do you place the first figure of the second partial product? Why?
5. What is the next to the largest number used in finding the quotient of 80,491 ÷ 27?
6. If a cubic foot of ice weighs 57 pounds, what will be the weight of a rectangular piece $2\frac{1}{2}$ ft. by $1\frac{1}{4}$ ft. by 1 ft.
7. What number must be added to $175\frac{5}{12}$ to make $317\frac{1}{9}$?
8. How many dozen bottles will be needed by a druggist to enable him to put 15 gallons of medicine into bottles holding $\frac{1}{4}$ of a gill each?
9. The same principle is used in changing $\frac{17}{25}$ to hundredths, and in dividing 0.096 by 0.08. Tell this principle.
10. A certain school-room is $30\frac{1}{2}$ ft. long, 25 ft. wide, and 12 ft. high. How many cubic feet of air does it contain?
11. What did its hard-pine floor cost at $56 per M.?
12. On one side and end are blackboards $4\frac{1}{4}$ ft. wide, costing $62\frac{1}{2}$¢ per square yard. Find their cost.
13. Write a check on some bank near you with which to pay a note of $75 that has been on interest for 2 yr. 8 mo. at 7%.
14. What is the price per M. when 600 ft. of lumber cost $18.42?
15. What will 4875 slate-pencils cost at 30¢ a hundred? At 60 a gross?

182.—Review Exercises.

WRITTEN.

1. How many days from Dec. 28, 1895, to March 31, 1896, including the latter day?
2. A prism of marble 6 ft. long and 16 in. square is bought for $2.75 per cubic foot. Find its cost.
3. It costs $0.75 a square foot to polish it. What will be the expense of polishing one end and the sides?
4. A farmer sells his crop for $1562.75. He has hired a man 5 months, at $35 a month, and two boys 147 days each, at $2.50 a week. If his remaining expenses were $423.75, what were his profits?
5. What part of a cord in 96 cubic feet?
6. How many cubic yards in 9 cords?
7. What part of a cubic foot is an 8-inch cube?
8. Find the average age of four girls whose ages are $12\frac{2}{3}$ yr., $13\frac{1}{2}$ yr., $15\frac{3}{4}$ yr., and $11\frac{5}{6}$ yr.
9. $16 is 40% of the cost of my watch. Should I gain or lose and how much, if I sold it for $50?
10. Make out Cyrus Rand's bill for Mrs. Emma Wyman. He owes for $13\frac{4}{7}$ weeks' board at \$9, and for $4\frac{7}{30}$ months' rent of rooms at \$12.
11. A grocer bought 164 lb. of butter for \$52.48, and sold 75 lb. of it at $37\frac{1}{2}$¢, and the rest of it at cost. What did he gain?
12. $\frac{3}{8}$ of 1296 is $\frac{5}{6}$ of what number of times 16?
13. A piano that cost $400 was sold for $375. What per cent was lost?
14. Find the amount of \$165.95 for 3 mo. 19 d. at $7\frac{1}{2}\%$ interest.
15. My gas bill is $12.85. I pay at the rate of $1.80 a thousand feet. How many feet do I burn?
16. Compare the length, surface, and volume of a 6-ft. cube and a cubic yard.

WRITTEN.

1. Find the difference between $\frac{9}{16}$ and $66\frac{2}{3}\%$.
2. What will $38\frac{7}{8}$ yards cost at $2.15 a yard?
3. How many gallons at $16\frac{1}{8}$¢ each can be bought for $144?
4. What will 78,250 bricks cost at $8.75 per M.?
5. Find the cost of 725 pails at $1.50 per dozen.
6. What shall I pay for 3000 pens at 0.37\frac{1}{2}$ per gross?
7. At $6\frac{2}{3}$¢ per square foot, how many square feet can I buy for $252?
8. At $1.75 per rod, what will it cost to fence a field $\frac{1}{2}$ a mile long, and $\frac{1}{4}$ a mile wide?
9. What will it cost to plough this field at $2.50 per acre?
10. How much money will be needed to pay the weekly wages in a manufactory employing
    16 hands, 8 hours a day, for 4 days, at $16\frac{2}{3}$¢ per hour;
    12 hands, $9\frac{1}{2}$ hours a day, for 6 days, at 20¢ per hour;
    19 hands, $7\frac{3}{4}$ hours a day, for 6 days, at 15¢ per hour?

What will balance the following cash accounts:—

	Dr.	*Cr.*		*Dr.*	*Cr.*
11.	68.49	6.49	**12.**	208.94	984.31
	73.65	83.91		716.91	62.91
	91.84	6.95		849.32	735.69
	118.37	8.17		764.21	84.17

13. $5 \div 0.05$ less $0.05 \div 5$ **14.** $0.006 \times 108\frac{1}{2} \div 400$

15. 3 yd. of ribbon contain 216 sq. in. How wide is the ribbon?
16. Mr. Farmer sells Mr. Wagner 25 bu. potatoes at 0.62\frac{1}{2}$; 9 bu. onions at $1.13; 84 lb. butter at 0.33\frac{1}{3}$; 13 doz. eggs at 28¢. He buys of him $2\frac{1}{2}$ lb. tea at 75¢; 6 lb. coffee at $58\frac{1}{3}$¢; $37\frac{1}{2}$ yd. cloth at $12\frac{1}{2}$¢; sundries, $3.72. How shall they settle?

184.—Review Exercises.

WRITTEN.

1. If the interest on my money is $128 for 8 mo., what will it be for 2 yr. 6 mo.?
2. What will be the cost of 7 joists, each 16 ft. long, 4 in. wide, and 3 in. thick, at $24 a thousand?
3. From an acre of land I sold a piece 6 rd. square, and also 6 sq. rd. How much is left?
4. What part of the year 1895 has gone at midnight, March 14th?
5. Make out Henry Marsh's account for Fox, Wilder & Co., following the form on page 143.

Dr.					*Cr.*		
Aug. 17, '93,	4⅓	doz. hats	@ $2		Sept. 14,	Cash	$8.35
" 25, "	3	pr. blankets	@ $3		" 18,	Labor	$12.38
" " "	14½	yd. silk	@ $2		" "	Mdse.	$6.42
" 27, "	13½	yd. carpet	@ 75¢				
" " "	12	yd. oilcloth	@ 63¢				

6. James Clark collects rents for his father, who gives him a commission of 2% of all he collects. If he collects as follows, how much does he earn?

Of Mr. Taylor	1	mo.'s rent, at	$400	a year
Of Mrs. Frye	2	" " "	$200	" "
Of Mrs. Tooney	¾	" " "	$150	" "

7. How many days can an engine be run with 14 tons of coal, if 735 pounds will run it one day?
8. What shall I pay for 4300 cu. ft. of gas at $2.50 per M., with a discount of 20% for cash?
9. Find the interest of half a million dollars for 1 day at 10%.
10. When taxes are $15 on every $1000, what shall I have to pay on property valued at $3250?

185.—Tables of Weights and Measures.

LIQUID MEASURES.

Liquid Measures are used in measuring liquids, — milk, oil, wine, vinegar, etc.

TABLE.

4 gills (gi.) = 1 pint (pt.)
2 pints = 1 quart (qt.)
4 quarts = 1 gallon (gal.)

DRY MEASURES.

Dry Measures are used in measuring fruit, grains, roots, etc.

TABLE.

2 pints = 1 quart
8 quarts = 1 peck (pk.)
4 pecks = 1 bushel (bu.)

Note. **The dry quart is nearly equal to 1⅙ liquid quarts.**

AVOIRDUPOIS WEIGHT.

Avoirdupois Weight is used in weighing all common articles.

TABLE.

16 ounces = 1 pound
2000 pounds = 1 ton (T.)
2240 pounds = 1 long ton

TIME MEASURE.

60 seconds (sec.) = 1 minute (min.)
60 minutes = 1 hour (h.)
24 hours = 1 day (d.)
365 days = 1 common year (yr.)
366 days = 1 leap year

7 days = 1 week; 12 calendar months = 1 year; 100 years = 1 century.

MEASURES USED IN COUNTING.

12 units = 1 dozen (doz.)
12 dozen = 1 gross (gro.)
20 units = 1 score

24 sheets = 1 quire
20 quires = 1 ream
10 reams = 1 bale

LENGTH MEASURES.

Length Measures have only one dimension, length. They are used in measuring lines or distances.

TABLE.

12 inches (in.) = 1 foot (ft.)
3 feet = 1 yard (yd.)
16½ feet, or 5½ yards = 1 rod (rd.)
320 rods, or 5280 feet = 1 mile (m.)

SQUARE OR SURFACE MEASURES.

Square or Surface Measures have two dimensions, length and breadth. They are used in measuring surfaces.

TABLE.

144 square inches (sq. in.) = 1 square foot (sq. ft.)
9 square feet = 1 square yard (sq. yd.)
30¼ square yards = 1 square rod (sq. rd.)
160 square rods = 1 acre (A.)
640 acres = 1 square mile (sq. m.)

SOLID OR CUBIC MEASURES.

Solid or Cubic Measures have three dimensions, length, breadth, and thickness. They are used in measuring solids or volumes.

TABLE.

1728 cubic inches (cu. in.) = 1 cubic foot (cu. ft.)
27 cubic feet = 1 cubic yard (cu. yd.)
16 cord feet = 1 cord foot (cd. ft.)
8 cord feet, or 128 cu. ft. = 1 cord (cd.)

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